UNIVERSITY OF ALBERTA

Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

by

Jennifer L. Branch

A dissertation submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

School of Library and Information Studies

Edmonton, Alberta

Fall 2000

National Library of Canada

Acquisitions and Bibliographic Services

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale du Canada

Acquisitions et services bibliographiques

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-59566-8

Canada

UNIVERSITY OF ALBERTA

Library Release Form

Name of Author: Jennifer L. Branch

Title of Thesis: Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

Degree: Doctor of Philosophy

Year the Degree Granted: 2000

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves all other publication and other rights in association with the copyright in the thesis, and except as herein before provided, neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.

Jennifer L. Branch

School of Information Science and Policy
Nelson A. Rockefeller College of Public Affairs and Policy
University at Albany, State University of New York
Draper Hall, Room 113
135 Western Avenue
Albany, New York
12222
U.S.A.

Wednesday, August 2, 2000

UNIVERSITY OF ALBERTA

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled *Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use* submitted by *Jennifer L. Branch* in partial fulfillment of the requirements for the degree of *Doctor of Philosophy*.

Dianne Oberg
Dr. Dianne Oberg

Hayden
Dr. Ruth Hayden

Jill McClay
Dr. Jill McClay

Anna E Altmann
Dr. Anna Altman

Leonard Stan Wilson
Dr. Stan Wilson

John Andrew Large
Dr. Andrew Large

Friday, July 28, 2000

ABSTRACT

The purpose of this research was to examine the information-seeking processes employed by junior high school students when using CD-ROM encyclopedias. The participants were junior high students from Inuvik, Northwest Territories, Canada. The participants, selected by their teachers, ranged in age from 11 to 14 and differed in academic abilities, in experiential and cultural backgrounds, and in knowledge of computers and CD-ROM encyclopedias.

This qualitative study used a variety of data collection methods. The participants were asked to search for the answers to four researcher-generated, four teacher-generated, and four self-generated questions. The amount of data was increased and enhanced by using two forms of verbal protocol analysis, Think Alouds and Think Afters. As the students searched the CD-ROM encyclopedias, they verbalized their thinking processes. The search screens was recorded on videotape and the Think Alouds were recorded on audiotape. Think Afters were generated by having the participants view their searches and comment on their information-seeking processes. The school context was explored through observations in the school and through interviews with participants and key informants.

The study revealed that participants needed both instruction and practice to develop the skills and strategies needed for full-text searching of CD-ROM encyclopedias. The

participants tended to use search terms only from the original question, had difficulty selecting topics and articles from the retrieved list, and did not read long articles as carefully as short articles. Factors determined to influence the information-seeking processes of these participants included finding the right keyword, knowing when to use a more general or specific term, computer experience, reading ability, time, and understanding the differences between databases, indexing and abstracting services, CD-ROM encyclopedias, and the Internet.

This study has implications for practice and research in areas related to library instruction. Instruction related to information seeking skills and strategies should focus on three main search tasks, that is, generating search terms, selecting topics from a retrieved list, and, skimming and scanning through text to find the answer. Instruction in skimming and scanning techniques to move through the long articles and in moving back and forth between screens would be useful for students of this age. Researchers are encouraged to use the methods from this study to look at the information-seeking processes of individuals and small groups students of different ages in different contexts, especially in multicultural and Aboriginal communities, and with different reference tools in print and electronic form.

DEDICATION

For the most important teachers in my life

My Family
Jane Branch
David Branch
John Branch
Dr. Christine Brandenburg

My Mentors
Dr. Dianne Oberg
Dr. Elizabeth Goodall

My Friends
Cheryl Baytaluke
Beverly MacInnis
Lisa D'Ambrose
Terry Richard
Donna Poirier
Ingrid Sutton
Doug O'Brien
Deb Pushor
Mary Allin

My Students

ACKNOWLEDGEMENTS

A great woman I know told me that a dissertation belongs to many people. I would like to take this opportunity to thank those people.

To begin with, I would like to acknowledge the love and support of my family. I am grateful for the evenings my mother spent with me at our kitchen table. It was here I learned to organize my notes, to memorize important details, to write complete sentences, to study for tests, and to finish my homework before watching television. I want to thank my mother for taking me to the Orillia Public Library every week and for letting me stay up 30 minutes after bedtime to read. I want to thank my father for the things he taught me about hard work and responsibility. It was through his example of going to work every day, even when he did not want to, that I was able to finish this dissertation.

I would like to thank my brother John for giving me the push, and for writing the letters of application to universities and signing my name. I am so lucky to be able to phone my brother and talk about my research and know that he is genuinely interested. John has given me the best example of life-long learning – although my Dad would like him to hurry up and get a real job. I would also like to thank Dr. Christy Brandenburg for setting an example, for her emails, for her letters containing relevant newspaper and magazine clippings, and, most importantly, for loving my brother.

I would like to thank my mentor and supervisor, Dr. Dianne Oberg. From our first meeting in Vancouver in 1997 to last breakfast at Denny's, she has provided all the support, encouragement, and free meals a doctoral student needs. Through her example of being both a fine teacher and researcher, she has given me a strong foundation on which to build my new career. I thank her for helping me set deadlines, for reading all my work, for mentoring me into academia, for her visit to Inuvik during data collection, and, most of all, for her friendship.

I would like to thank Dr. Elizabeth Goodall for helping me develop the focus for this study and for her continuing, long-distance care about me and my research. She showed me what the relationship between student and supervisor should be and then let me go when it was in my best interest. It is something for which I will always be grateful.

I would like to acknowledge the support of the other members of my dissertation committee; Dr. Ruth Hayden, Dr. Jill McClay and Dr. Anna Altmann. Ruth could always be counted on the ask the tough questions, and to make the work better as a result. Jill

could always be counted on to make the writing better and to make me feel better. Anna could always be counted on to be the calming influence, especially during the Candidacy and the defense, and when I was three pasta bowls and a salad plate short of a full set.

The faculty in the School of Library and Information Studies has provided me with a warm and collegial atmosphere in which to study, teach, and to do research. I am especially grateful to Dr. Alvin Schrader for his encouragement, Dr. Toni Samek for her fine example of keeping academic life in perspective, Dr. Hope Olson for her broad perspectives, Dr. Margaret Mackey for letting me learn at her side how to do good research with children and adolescents, and Professor Lisa Given for understanding the whole process and being willing to talk about it every day. I would also like to thank Darlene Syrotuik, Joanne Hilger, Sophia Sherman and Bernadine Reil for their kindness during the my two years at the School.

I would like to thank Cheryl Baytaluke for taking the photographs in Chapter 4, for daily phone calls, for letting me stay at her house during data collection, for unending support, for bitching to me and with me, and most of all for proving everyday that great friendships grow stronger across great distances. I would like to thank Beverly MacInnis for sharing her office and her kettle, for always being there when I needed her, and for listening when I just needed to talk it all out. I want to thank Doug O'Brien for dinners, movies and for reading parts of the manuscript and for offering such helpful comments. I would like to thank Debbie Pushor for being on the same road at the same time and for making the journey that much more safe and that much more fun. I would like to thank Mack Male for his technical help throughout the dissertation and for being such an important connection between my old life and my new one.

I would like to thank Donna Poirier for her care and for getting me away from it all when I needed it most. I would like to thank Ingrid Sutton for giving me something else to think about and for holding the flag and transporting my clubs, and for putting up with me when my shots and my life were in the rough. I would like to thank Lisa D'Ambrose for being there when it all began in Sam's class and for sticking with me through it all. I would like to thank Terry Richard for believing in me when I did not know how to believe in myself. I would like to thank Mary Allin for helping to take care of my mother so I could take care of this.

I would like to thank the teachers and staff of Samuel Hearne Secondary School for their help with this research and also for their friendship during my six years in the community. I would like to thank my participants and their families, the Inuvik Community Corporation, the Gwich'in Tribal Council, the Town of Inuvik, the Inuvik

District Education Authority, the Beaufort Delta Education Council, and the Aurora Research Institute for their support of this research. I would like to thank the University of Alberta for their financial support in the form of the University of Alberta Graduate Fellowship and the J. Gordin Kaplan Travel Bursary.

Finally, I would like to thank my students, from grade one to graduate school in Webequie, Fort Hope, Inuvik and Edmonton, who have been such an important part of my life and who taught me so much about myself.

TABLE OF CONTENTS

CHAPTER 1
Introduction **1**
- 1.1 Introduction to the Problem 1
- 1.2 Background to the Problem 2
- 1.3 Statement of the Problem 3
- 1.4 Boundaries 4
- 1.5 Definitions 5
- 1.6 Significance 7
- 1.7 Overview of Dissertation 7

CHAPTER 2
Review of the Literature **9**
- 2.1 Introduction 9
- 2.2 Information Literacy 9
- 2.3 Information-seeking Theory 10
- 2.4 Information-seeking in Electronic Environments 16
- 2.5 Schema Theory and Mental Model Theory 23
- 2.6 Schema and Mental Models in Electronic Environments 25
- 2.7 Reading Theory 26
- 2.8 Reading in Electronic Environments 28
- 2.9 Children and Adolescents as Information Seekers 32
- 2.10 Chapter Summary 34

CHAPTER 3
Research Methodology **36**
- 3.1 Introduction 36
- 3.2 The Role of the Researcher 37
- 3.3 Case Study 38
- 3.4 Selection of Participants and Key Informants 40
- 3.5 Ethical Considerations 41
- 3.6 Data Collection Procedures 44
  - 3.6.1 Think Alouds and Think Afters 45
    - 3.6.1.1 Review of Literature on Think Alouds and Think Afters 45
    - 3.6.1.2 The Pilot Study 48
    - 3.6.1.3 Collecting the Data 49
  - 3.6.2 Observation 50
    - 3.6.2.1 Review of Literature on Observation 51
    - 3.6.2.2 Collecting the Data 52
  - 3.6.3 Interviews 52
    - 3.6.3.1 Review of the Literature on Interviews 53
    - 3.6.3.2 Collecting the Data 53
  - 3.6.4 Capturing Search Data 55
    - 3.6.4.1 Review of the Literature on Capturing Search Data 55
    - 3.6.4.2 Collecting the Data 56
  - 3.6.5 The Research Setting 56
  - 3.6.6 Introduction to the CD-ROM Encyclopedias 56
  - 3.6.7 Search Session 1 57
  - 3.6.8 Search Session 2 57
  - 3.6.9 Search Session 3 58

3.7 Data Analysis Procedures 59
3.8 Chapter Summary 63

CHAPTER 4
Research Context and Participant Profiles 64

4.1 Introduction 64
4.2 Inuvik 64
4.3 Inuvik Centennial Library 67
4.4 Sir Alexander Mackenzie School 68
4.5 Samuel Hearne Secondary School 69
4.6 The Senior High 71
4.7 The Junior High 71
4.8 The Study Location 72
4.9 The Interviews 73
4.10 "On the land" and "Down the road" 73
4.11 The Communities 74
4.12 The Profiles 75
  4.12.1 Eric 75
  4.12.2 Paul 76
  4.12.3 Fran 77
  4.12.4 Carol 78
  4.12.5 Dave 79
  4.12.6 Ken 80
  4.12.7 Lynn 80
  4.12.8 Abby 82
  4.12.9 Chris 82
  4.12.10 Bob 84
  4.12.11 Mary 85
  4.12.12 Sue 85
4.13 The Key Informants 86
4.14 Chapter Summary 87

CHAPTER 5
Findings 88

5.1 Introduction 88
5.2 Search Session 1 89
  5.2.1 Initial Search Terms – First Woman in Space 89
  5.2.2 Initial Search Terms – Cardinal 91
  5.2.3 Initial Search Terms – First Man in Space 92
  5.2.4 Initial Search Terms – Boxer 93
  5.2.5 Information-seeking Processes – First Woman in Space 93
  5.2.6 Information-seeking Processes – Cardinal 98
  5.2.7 Information-seeking Processes – First Man in Space 100
  5.2.8 Information-seeking Processes – Boxer 102
5.3 Search Session 1 Summary 104
5.4 Search Session 2 105
5.5 Search Session 2 – Grade 7 Questions 105
  5.5.1 Information-seeking Processes – Alaska Pipeline 106
  5.5.2 Information-seeking Processes – Alaska Flag 108
  5.5.3 Information-seeking Processes – Alaska Capital City 109
  5.5.4 Information-seeking Processes – Alaska Earthquake 111
5.6 Search Session 2 – Grade 8 Questions 113

5.6.1 Information-seeking Processes – Official Language of Egypt 114
5.6.2 Information-seeking Processes – Reign of Ramses II 116
5.6.3 Information-seeking Processes – Origin of the Word Pharaoh 118
5.6.4 Information-seeking Processes – Flag and Anthem of Egypt 119
5.7 Search Session 2 – Grade 9 Questions 120
5.7.1 Information-seeking Processes – Welland Canal 121
5.7.2 Information-seeking Processes – Country on Equator 123
5.7.3 Information-seeking Processes – Nelson River 126
5.7.4 Information-seeking Processes – Tropic of Cancer 126
5.8 Search Session 2 Summary 127
5.9 Search Session 3 128
5.9.1 Eric 128
5.9.2 Paul 131
5.9.3 Fran 134
5.9.4 Carol 138
5.9.5 Dave 141
5.9.6 Ken 143
5.9.7 Lynn 146
5.9.8 Abby 149
5.9.9 Chris 151
5.9.10 Bob 154
5.9.11 Mary 157
5.9.12 Sue 160
5.10 Search Session 3 Summary 162
5.11 Key Informants 163
5.12 Dissertation Questions 164
5.12.1 Information-seeking Processes 165
5.12.2 Search Sessions 1, 2 and 3 167
5.12.3 Factors Influencing Information-seeking Processes 168
5.13 Chapter Summary 171

CHAPTER 6
Discussion 174
6.1 Introduction 174
6.2 Information Literacy 174
6.3 Information-seeking Theory 175
6.4 Information-seeking in Electronic Environments 189
6.5 Schema and Mental Models in Electronic Environments 198
6.6 Reading in Electronic Environments 199
6.7 The Trouble with Think Alouds 202
6.8 Children and Adolescents as Information Seekers 213
6.9 Chapter Summary 214

CHAPTER 7
Implications and Conclusion 217
7.1 Introduction 217
7.2 Information Literacy 217
7.2.1 Implications for Practitioners 217
7.2.2 Implications for Researchers 218
7.3 Information-seeking Theory 219
7.3.1 Implications for Practitioners 219
7.3.2 Implications for Researchers 220

7.4 Information-seeking in Electronic Environments 220
  7.4.1 Implications for Practitioners 220
  7.4.2 Implications for Researchers 222
7.5 Schema and Mental Models in Electronic Environments 222
  7.5.1 Implications for Practitioners 222
  7.5.2 Implications for Researchers 223
7.6 Reading in Electronic Environments 223
  7.6.1 Implications for Practitioners 223
  7.6.2 Implications for Researchers 225
7.7 Think Alouds and Think Afters 226
  7.7.1 Implications for Practitioners 226
  7.7.2 Implications for Researchers 226
7.8 Children and Adolescents as Information Seekers 227
  7.8.1 Implications for Practitioners 227
  7.8.2 Implications for Researchers 228
7.9 Conclusion 228

REFERENCES **239**

APPENDICES **253**

LIST OF TABLES

Table I 13
Kuhlthau's Information Search Process Model

Table II 14
The Big Six Skills

Table III 43
Interethnic Communication Areas of Confusion

Table IV 89
Time Needed to find the Answers in Search Session 1

Table V 90
Initial Search Terms in Search Session 1

Table VI 105
Initial Search Terms used by Grade 7s in Search Session 2

Table VII 106
Time Needed by Grade 7s to find Answers in Search Session 2

Table VIII 113
Initial Search Terms used by Grade 8s in Search Session 2

Table IX 114
Time Needed by Grade 8s to find Answers in Search Session 2

Table X 121
Initial Search Terms used by Grade 9s in Search Session 2

Table XI 121
Time Needed by Grade 9s to find Answers in Search Session 2

Table XII 128
Eric's Search Session 3

Table XIII 131
Paul's Search Session 3

Table XIV 134
Fran's Search Session 3

Table XV 138
Carol's Search Session 3

Table XVI 141
Dave's Search Session 3

Table XVII 143
Ken's Search Session 3

Table XVIII 146
Lynn's Search Session 3

Table XIX 149
Abby's Search Session 3

Table XX 151
Chris' Search Session 3

Table XXI 154
Bob's Search Session 3

Table XXII 157
Mary's Search Session 3

Table XXIII 160
Sue's Search Session 3

Table XXIV 207
Number of Coded Statements by Search Session

Table XXV 209
Number of Statements in Complex Searches (Questions 1 and 3)

Table XXVI 210
Number of Statements in Simple Searches (Questions 2 and 4)

LIST OF FIGURES

Figure 1 65
View of Inuvik

Figure 2 65
The Igloo Church

Figure 3 66
View of Downtown Inuvik

Figure 4 66
Inuvialuit Corporate Centre

Figure 5 67
The Chief Jim Koe Zheh (Gwich'in Offices)

Figure 6 67
Inuvik Centennial Library

Figure 7 68
Videos in front of Dick Hill Collection

Figure 8 68
Reading Corner in Inuvik Centennial Library

Figure 9 69
Sir Alexander Mackenzie School

Figure 10 70
Samuel Hearne Secondary School

Figure 11 70
Centennial Statue in front of SHSS

Figure 12 71
SHSS Library

Figure 13 71
Fire Hall & Town Office

Figure 14 72
Junior High Computer Lab

Figure 15 74
Dempster Highway Sign #1

Figure 16 74
Dempster Highway Sign #2

Figure 17 75
Ice Road to Aklavik and Tuktoyaktuk

Figure 18 94
Sally Ride Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 19 95
Tereshkova Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 20 96
Space Exploration Article in 1999 World Book (Deluxe)

Figure 21 97
First Woman in Space Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 22 98
Cardinal Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 23 99
Cardinal Article in 1999 World Book (Deluxe)

Figure 24 100
Space Exploration Article in 1999 World Book (Deluxe)

Figure 25 101
Vostok Program Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 26 103
Boxer Article in 1999 World Book (Deluxe)

Figure 27 103
Domestic Dogs Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 28 107
Alaska Article in 1999 World Book (Deluxe)

Figure 29 108
Alaska in Brief Article in 1999 World Book (Deluxe)

Figure 30 109
Alaska Article in 1999 World Book (Deluxe)

Figure 31 111
Juneau Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 32 112
Earthquake Hits Anchorage Picture in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 33 115
Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 34 116
Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 35 117
Ramses II Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 36 117
Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 37 118
Pharaoh Article in 1999 World Book (Deluxe)

Figure 38 120
Egypt Article in 1999 World Book (Deluxe)

Figure 39 122
Welland Canal Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 40 124
Interactive World Map in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 41 125
South America Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 42 126
Nelson River Article in 1999 World Book (Deluxe)

Figure 43 127
Tropic of Cancer Article in 1999 World Book (Deluxe)

Figure 44 129
World Cup Championship Games in 1999 World Book (Deluxe)

Figure 45 129
Snake Article in 1999 World Book (Deluxe)

Figure 46 130
Stanley Cup Winners from Microsoft Encarta Encyclopedia Deluxe 2000

Figure 47 132
Atlantis Article in 1999 World Book (Deluxe)

Figure 48 133
History of Motion Pictures Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 49 135
China Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 50 136
City Article in 1999 World Book (Deluxe)

Figure 51 136
Russia Article in 1999 World Book (Deluxe)

Figure 52 137
India Article in 1999 World Book (Deluxe)

Figure 53 139
Canada Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 54 139
History of Canada Article in 1999 World Book (Deluxe)

Figure 55 140
Music Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 56 140
Witch Article in 1999 World Book (Deluxe)

Figure 57 142
Snowmobile Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 58 142
Baseball Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 59 144
UFO Article in 1999 World Book (Deluxe)

Figure 60 144
Hockey Article in 1999 World Book (Deluxe)

Figure 61 145
Ice Hockey Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 62 147
Rugby World Cup Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 63 147
Television Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 64 148
Basketball Article in 1999 World Book (Deluxe)

Figure 65 149
1908 Timeline in 1999 World Book (Deluxe)

Figure 66 150
Northwest Territories Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 67 150
Northwest Territories Article in 1999 World Book (Deluxe)

Figure 68 152
Quebec Article in 1999 World Book (Deluxe)

Figure 69 153
Rocket Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 70 155
Platypus Article in 1999 World Book (Deluxe)

Figure 71 155
Manhattan Project Article in 1999 World Book (Deluxe)

Figure 72 156
Guitar Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 73 158
Mackenzie River Article in 1999 World Book (Deluxe)

Figure 74 158
Inuit Article in 1999 World Book (Deluxe)

Figure 75 159
Automobile Racing Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 76 160
Dugong Article in 1999 World Book (Deluxe)

Figure 77 161
Supernova Article in 1999 World Book (Deluxe)

Figure 78 186
Countries of Africa Map in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 79 196
Music Article in Microsoft Encarta Encyclopedia Deluxe 2000

Figure 80 196
Snake Article in 1999 World Book (Deluxe)

Figure 81 197
World Cup Championship Games in 1999 World Book (Deluxe)

Figure 82 205
The Three Dimensions of Mastery

Figure 83 224
Space Exploration Article in 1999 World Book (Deluxe)

LIST OF APPENDICES

APPENDIX A 253
School of Library and Information Studies Ethics Review Guidelines

APPENDIX B 256
School of Library and Information Studies Ethics Approval

APPENDIX C 258
Notification to Community Organizations of Research License

APPENDIX D 261
Northwest Territories Research License

APPENDIX E 263
Letter of Introduction to Key Informants

APPENDIX F 265
Consent Form for Key Informants

APPENDIX G 267
Letter of Introduction to Parents

APPENDIX H 269
Consent Form for Participants

APPENDIX I 271
Permission Form for Parents

APPENDIX J 273
Letter to Participants and Parents about Profiles

APPENDIX K 275
Continued Participation Consent Forms for Participants

APPENDIX L 277
Continued Participation Consent Forms for Parents

APPENDIX M 279
Think Aloud Transcript Example

APPENDIX N 287
Think After Transcript Example

APPENDIX O 291
Introduction to Think Alouds, Think Afters, and the CD-ROM Encyclopedias

APPENDIX P 294
Research Chronology

APPENDIX Q 298
Instructions for Search Session 3

CHAPTER 1

INTRODUCTION

1.1 Introduction to the Problem

> *On my very first day as a teacher-librarian in my very first school library north of the Arctic Circle and more than 7000 kilometres from home, I realized two things. The first was that I had no idea how to be a teacher-librarian and the second was that computers were going to be an important part of this brand-new job. On my very first day, I remember doing two things. I spent some time exploring the brand new computer in the school library and I put my head in my hands, completely overwhelmed by this new technology. I remember two things about that computer. It had an external CD-ROM drive and it had the full-text CD-ROM of the Grolier Electronic Encyclopedia.*

From that very first day, I have been interested in CD-ROM encyclopedias. I watched students using that very first text-only CD-ROM encyclopedia and I watched them exploring CD-ROM encyclopedias with sound, animation, graphics, video and voice activated commands. The encyclopedias and I have come a long way. Over seven years at Samuel Hearne Secondary School, I saw that junior high students were experiencing difficulties with the CD-ROM technology in the library. Time spent working with CD-ROMs didn't seem to help overcome these difficulties for many students. The multimedia features of the CD-ROM encyclopedias were affecting how the students were accessing and using information. In 1995-96, I went on education leave in order to study this issue at The Robert Gordon University in Aberdeen, Scotland. During my time there, I visited secondary schools in Aberdeen and saw again the difficulties that students experienced with finding information in CD-ROM encyclopedias.

As a result of this long-time interest in students' use of CD-ROM encyclopedias, I decided to begin research on the information-seeking processes that junior high students employ as they access information. The research began in Scotland in 1995 and continued when I returned to Inuvik in September of 1996. The times and places may have changed but the basic questions have not. What is it that kids do when they access information from CD-ROM encyclopedias? How can teachers and teacher-librarians help? How can we make sure that all kids have equal access to CD-ROM encyclopedia information? What strategies and processes do students use when they successfully gather information from CD-ROM encyclopedias? How can we help all students develop these strategies and processes?

1.2 Background to the Problem

Many teacher-librarians are unaware of the information-seeking strategies that will be most effective when using CD-ROM encyclopedias (Liebscher & Marchionini, 1988). These tools, although containing some of the same types of information as print encyclopedias, are quite different in terms of access. Because such a large amount of information is available to students on a CD-ROM, the program in school libraries must deal with helping students recognize, select and use information that most meets their needs (Baumbach, 1990). Perzylo (1993) explained the need for teachers to be aware of the skills that students must attain for this information technology. The roles of the teacher-librarian and the teacher in the information technology school are very important ones. Teachers and teacher-librarians need to become careful observers of how students use multimedia in real educational settings (Liebscher & Marchionini, 1988; Yildiz & Atkins, 1993). They also need to be active participants in helping students to successfully locate information that can help solve their information problems.

Mendrinos (1994) pointed out that multimedia CD-ROMs are redefining learning because they are meeting the needs of diverse populations and promoting literacy through "visual, auditory, tactile and textual images of knowing" (p. 63). However, each CD-ROM encyclopedia is not searched in the same way. Matthews (1990) proposed that students would need to adapt new and different search procedures and strategies when using each CD-ROM encyclopedia. Students will need "a knowledge of special options and facilities which are available ... and the ability to exploit these facilities to maximum effect as the search progresses (p. 49). Being able to use these skills successfully in many situations will enable students to discover and organize knowledge in an information society (Butterworth, 1992; Mendrinos, 1989, 1994). For students to fulfil their lifelong informational needs, the process of learning these skills should begin as soon as possible but should be stressed at the upper elementary and junior high school level (Mendrinos, 1994). According to Marchionini (1989b), the encyclopedia "is a primary source of initial information for secondary school students" (p. 594). De Corte (1990) discussed that "being able to process, organize, and retrieve information with a view to problem solving [are] essential skills of every individual in our complex societies, in which information has become the major kind of raw material" (p. 5).

Schools and school curricula are being influenced by "the rapid development, application and uptake of interactive multimedia technologies" (Oliver & Oliver, 1996, p. 33). There is a focus on information skills as new curricula are being developed to address the needs of students who have access to information technologies and who are going to live and work in the information age. For Pappas (1993), these new curricula should "reflect the unique searching possibilities of these resources" (p. 11). Eisenberg & Spitzer (1991) pointed out that a goal of education must be to help students use information technology for school assignments and personal pleasure to ensure life-long learning.

Hammond (1994) stated that "there is a common sense view, shared by government, industry and by many parents, that information technology is a good thing" (p. 251). As a result, some see this technology as a good thing with only positive developments for education and school libraries. Many authors have pondered the question of the impact of information technology on schools and school libraries. Soloway (1991) proposed that the most significant changes in education in this century would be the result of information technology. This technology will result in a rethinking of what should be learned and how. Rothenberg (1994) added that "information technology supplies a new, powerful set of complex tools that can change teaching and learning dramatically, if not transform it entirely" (p. 279).

1.3 Statement of the Problem

My research examined the information-seeking processes which junior students at Samuel Hearne Secondary School in Inuvik, Northwest Territories employ when using CD-ROM encyclopedias. In junior high, students' classroom work requires them to access much more information than any time previously in their school career. Students at this age can begin to gain some independence when searching for information. The study included junior high students with a range of experiences, knowledge of computers and CD-ROM encyclopedias, and academic abilities selected by their core classroom teachers. The context within which the participants search was explored through observations in the school and through interviews with the key informants in the school.

I used verbal protocol analysis, the Think Aloud and Think After methods, interviews, observation, and videotapes of the searches to gain an understanding of the information-seeking processes of twelve junior high students. Students searched for the answers to several questions, generated Think Alouds and Think Afters and answered interview questions to uncover factors the participants saw as important to their information-seeking processes. The talk of the students was recorded using audiotapes and videotapes. After completing the Think Alouds, students watched the video of their searches and were asked to elaborate on their information-seeking processes in the Think Afters. These methods allowed me to gain an insight into the affective, sensorimotor and cognitive processes of the students.

Relevant literature from LIS, education, and psychology has been reviewed to assess learning theories, models and research that may be applied to this specific, real-life situation. Think Aloud and Think After data is related to existing theories and models. Implications from this case study will help teacher-librarians when teaching junior high students how to access information more effectively from electronic encyclopedias and other online research tools.

The major research question was:

- What information-seeking processes do junior high students use when accessing CD-ROM encyclopedias?

Two other research questions were:

- How similar and different are these information-seeking processes when junior high students search for information on self-generated, teacher-generated and researcher-generated topics?
- What factors do participants, key informants and the researcher see as important to an understanding of the information-seeking processes of junior high students?

1.4 Boundaries

This case study was limited to twelve junior high students in one school. The three core classroom teachers were asked to select junior high students with a variety of experiential backgrounds and different academic abilities. I was interested in participants who had different reading abilities, language and travel experiences, and ethnic and aboriginal backgrounds. The three core teachers, as well as a career and technology studies teacher and the Library Assistant were the key informants for this research. Samuel Hearne Secondary School was selected as the case because it is has a very interesting cultural mix and because of its emphasis on information technology over the past eight years. A majority of the students in the school are Inuvialuit and Gwich'in. However, there are also students from a variety of other ethnic backgrounds who were born in many other parts of Canada and the world. I was also interested in this case because I am familiar with the cultural mix. Very few other communities in the Northwest Territories have such a diverse population. It is also a very isolated location and the different life experiences of the diverse students were of interest to me in relation to their information-seeking processes.

As a former teacher in the school and member of the community, I had an inside/outsider perspective. I had knowledge of the school and community but looked at each with fresh eyes. I believe most participants saw me as a teacher rather than a researcher. It was important that the participants understood that any information given to me would not affect their classroom grades or relationships with teachers or administration. It was also important to me that the participants felt that they were cared for and respected. I also explained to key informants that my role in this study was different from the collegial one already established. I believe that key informants felt safe to speak frankly about the topic. As I no longer live in the community, there was a time limitation to this research. I stayed for nine weeks in the community and spent almost every day at the school. The research took place in September, October, and November of 1999.

1.5 Definitions

A variety of terms exist in the literature of information seeking that may be confusing to readers of this proposal. Distinctions need to be made immediately between computer literacy, information literacy, information skills, information technology and educational technology as several of the terms may be used interchangeably. Herring (1992) pointed out that "computer literacy would tend to suggest mechanical ability" (p. viii) and this term will rarely be used in this proposal. Information literacy has been defined as the ability to use skills and techniques to access and use the complete range of primary and secondary information sources to solve problems. Information literacy, as defined by Mendrinos (1992), "is a process of critical, lateral, and branching thought strategies to seek, gather, retrieve, analyze, synthesize, evaluate, and apply information from all formats to solve problems" (p. 29). Information literacy, then, is the ability to locate, gather, evaluate and create products from information in areas of life such as home, school, work and leisure.

For this researcher, information skills are distinct skills that people use when interacting with information. These skills, once identified, can then be taught to others. Information technology is simply the hardware, for example, computers, printers, CD-ROM players, fax machines, video players, and modems, and software, for example, CD-ROMs, word processing programs, spreadsheet programs, Internet, electronic communications and online services, that may be used by a person when trying to solve a problem. Educational technology and information technology can be used interchangeably in the literature. While Educational technology is the technology used specifically in schools, in this study the term information technology will be used to refer to the technology found in schools and school libraries and, therefore, used for an educational purpose.

Clarification between information retrieval and information seeking also needs to be made. It is important to note that information retrieval is a term used mainly in the information science literature. Information retrieval refers to locating a specific document or list of documents from a source such as an abstracting or indexing service while information seeking is the whole process of solving a problem. Therefore, information retrieval is but a part of the whole process of information seeking. Information-seeking strategies are the step-by-step procedures a person uses to find information. This would include, for example, entering in a search term, reading the information and printing out the information. Information-seeking processes are the processes that would include, for example, determining which search term to use, and reading processes such as skimming and scanning to determine relevance of the information to the problem. Skimming will be used in this study to refer to the process of reading hastily. Scanning is used when referring to the process of quickly but systematically searching for particular information. The information-seeking processes include all the skills and strategies as well as the metacognitive processes that participants may use in their searches.

The term multimedia is reserved for computer-based programming that combines at least three of these seven media: text, data, audio, graphics, still pictures, animation or moving pictures. Pappas (1993) differentiated between print and electronic resources. Print tools are organized more linearly than electronic tools which reflect "a nonlinear and dynamic approach to organizing information" (p. 11). These electronic tools provide the opportunity for students to develop an analytical search strategy, for example, Boolean logic.

Snyder (1996) differentiates between hypertext and hypermedia in the preface to Hypertext: The Electronic Labyrinth. Hypertext is an information medium that exists only online in a computer. A structure composed of blocks of text connected by electronic links, it offers different pathways to users. Hypertext provides a means of arranging information in a nonlinear manner with the computer automating the process of connecting one piece of information to another. When the structure accommodates not only printed texts but also digitized sound, graphics, animation, video and virtual reality, it is referred to as hypermedia (p. ix).

Verbal protocol analysis is a research method used predominantly as a way to gain information about the cognitive processes of a participant's internal states using verbal reports. Two methods of verbal protocol analysis were used in this study. Concurrent verbal protocols are also referred to as talk aloud, think aloud or thought-listing techniques. Retrospective verbal reports, the second method, rely on gathering information after a task is completed. For this study, the terms Think Alouds and Think Afters will be used.

1.6 Significance

This study provides an understanding of how a small number of junior high students in Inuvik, Northwest Territories search for information on CD-ROM encyclopedias. The findings of this research provide significant information for teachers and teacher-librarians who are interested in information-seeking processes in electronic environments. An in-depth understanding can inform teachers and teacher-librarians about the needs of students to be successful in electronic environments. This study describes how the junior high students interact with and use information from text, graphics, video and animation and how they navigate within CD-ROM encyclopedia systems. It also provides an understanding of the search strategies and search terms these students employ in a variety of information problems. Teachers and teacher-librarians will be able to use the research as a basis to begin their own observations of the information seeking of students in their schools. The use of the Think Aloud method and Think After method will also be significant. The methods have been used infrequently in LIS research.

1.7 Overview of Dissertation

This dissertation is organized into seven chapters. Chapter 2 includes an overview of the literature in the following areas:

- Information Literacy
- Information-seeking Theory
- Information Seeking in Electronic Environments
- Schema Theory and Mental Model Theory
- Schema and Mental Models in Electronic Environments
- Reading Theory

- Reading in Electronic Environments
- Children and Adolescents as Information Seekers

Chapter 3 presents the methodology for the research. Chapter 4 explores the context of the research, shares the profiles of the twelve participants and introduces the key informants. Chapter 5 details the findings of the research. It looks at the information-seeking processes of the participants during research-generated, teacher-generated, and self-generated questions. Chapter 5 also presents the findings from the key informants and addresses the three research questions that guided the study. Chapter 6 explores the connection between previous research and the findings from this research. Chapter 7 discusses the implications of this research for practitioners and researchers. The conclusion is also included in Chapter 7. The References and Appendices immediately follow Chapter 7.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Introduction

The nature of information seeking requires an understanding of theoretical and practical applications in a number of fields including education, psychology, and LIS. Any discussion of the complex phenomenon of information seeking involves an exploration of the literature in many areas. To begin, an introduction to the idea of information literacy is discussed. Next an overview of some of the important information-seeking theories and models is presented followed by recent research about information seeking in electronic environments. A short discussion of schema theory and mental model theory will be included as well as a review of research related to the theories. Since it is anticipated that reading will be an important part of this research, a brief discussion of reading theory and reading in electronic environments follows. A short review of information-seeking research using children and adolescents as participants is also included.

2.2 Information Literacy

This study seeks to describe a small piece of the much larger puzzle of information literacy. The American Association of School Librarians (AASL) and the Association for Educational and Communications Technology's (AECT) (1998) Chapter 2 of Information Power: Building Partnerships for Learning lists nine student standards for information literacy:

> Standard 1: The student who is information literate accesses information efficiently and effectively.
> Standard 2: The student who is information literate evaluates information critically and competently.
> Standard 3: The student who is information literate uses information accurately and creatively.

> Standard 4: The student who is an independent learner is information literate and pursues information related to personal interests.
> Standard 5: The student who is an independent learner is information literate and appreciates literature and other creative expressions of information.
> Standard 6: The student who is an independent learner is information literate and strives for excellence in information seeking and knowledge generation.
> Standard 7: The student who contributes positively to the learning community and to society is information literate and recognizes the importance of information to a democratic society.
> Standard 8: The student who contributes positively to the learning community and to society is information literate and practices ethical behavior in regard to information and information technology.
> Standard 9: The student who contributes positively to the learning community and to society is information literate and participates effectively in groups to pursue and generate information. (p. 8)

These standards provide a clear picture of the importance of information literacy for life-long learning.

For Irving (1985), literacy is "the freedom to think, to manipulate the thoughts of oneself and others, and the freedom to express the resulting synthesis" (p 152). For Eisenberg and Spitzer (1991), "those who are information literate will truly have the ability to be lifelong learners and fully participate in the information society" (p. 274). Kuhlthau (1995) pointed outs that it is a great challenge to teach students in the information age. It is imperative for children to understand the learning process so that they can survive information overload. Since many students interact with print and electronic encyclopedias to search for information, the way students use these tools and the success they have is critical to becoming information literate.

2.3 Information-seeking Theory

Many models to describe information-seeking behaviour have been developed by researchers in various disciplines. Brown (1991) found that the first information-seeking models were document-oriented, that is, they were concerned with the retrieval of documents from abstracting and indexing services. Later, information seeking became seen as role-oriented and focused on the information needs of the individual in relation to their role in an organization and the needs of that organization. Brown went on to suggest that the latest trend in information seeking "views the individual as a person with fundamental physiological, affective, and cognitive needs (the self) who operates within a role which is part of an environment with socio-cultural and politico-economic concerns" (p. 10).

One of the early information-seeking models is that of Robert Taylor (1968). His research focused on the reference interview and discovered four stages of information seeking. The first, which Taylor called Q1, "is the actual, but unexpressed need for information (the visceral need)" (p. 182). The second (Q2) is the conscious need that may be unclear and incoherent. The information seeker may talk to others during this level to try to clear up the confusion. At the third level (Q3), the information seeker "can form a qualified and rational statement" (p. 182). The fourth level (Q4) is the final level where the information seeker now has to put the question to the information system. In this final level, the information seeker must consider the kinds of information sources that might answer the question. This four-step model is more appropriate for academic libraries and reference librarians but is interesting as one of the first attempts to analyze the process of information seeking.

Bates (1989) argued that her "berrypicking" model of information seeking "is much closer to the real behaviour of information searchers" (p. 407). This dynamic model stressed that real searchers, rather than finding information using one single search query, gather the bits and pieces of information in a "berrypicking" manner. For Bates, "each piece of information they encounter gives them new ideas and directions to follow and, consequently, a new conception of the query" (pp. 409-410). Bates cited among others the work of Kuhlthau and her information search process as support for this berrypicking idea. The work of Kuhlthau will be discussed later in this section. The nature of information seeking in CD-ROM encyclopedias may indeed be like the "berrypicking" model.

The work of Irving (1982) was based on information seeking in school libraries and her understanding that all learning is inherently connected to information. Her model was a process one which concentrated on "the cognitive skills of information collection as well as information generation, information storage, information retrieval, information communication and the use of information" (p. 15). Early in the information technology revolution, Irving postulated that computers would become the information storage for our brains. This would leave people free to "do the processing and manipulation, the understanding and application" (p.15). This process approach to information seeking has become very important to the field of information science. The process approach assumes that the source of the information or the seeker of the information is less important than the process. These approaches look at the similarities in information-seeking process.

Kuhlthau's work has presented another process approach to information seeking (Kuhlthau, 1983, 1988a, 1991, 1993). It continued the trend "of a shift in emphasis from concentration on document or text representations and associated search techniques to the study of users in information-seeking situations" (Kuhlthau, 1991, p. 361). This Information Search Process (ISP) model included affective, cognitive and physical aspects of the whole information-seeking process. It was the inclusion of all three aspects that, for Kuhlthau (1991), was "necessary for a model to address a wider, holistic view of information use" (p. 362). Her findings indicated that searchers experience six stages as they complete a search for information. These stages are called Initiation, Selection, Exploration, Formulation, Collection and Presentation. According to Kuhlthau, all information seekers pass through these same six stages when completing a research project.

Table I: Kuhlthau's Information Search Process Model

Stages	Feelings	Thoughts	Actions	Tasks
Initiation	Uncertainty	General/Vague	Seeking Background Information	Recognize
Selection	Optimism			Identify
Exploration	Confusion/ Frustration/ Doubt		Seeking Relevant Information	Investigate
Formulation	Clarity	Narrowed/ Clearer		Formulate
Collection	Sense of Direction/ Confidence	Increased Interest	Seeking Relevant or Focused Information	Gather
Presentation	Relief/ Satisfaction or Disappointment	Clearer or Focused		Complete

Source: Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. Journal of the American Society for Information Science, 42(5), 367.

Kuhlthau's ISP model was initially developed as a result of a qualitative study of high school seniors as they carried out research projects. Kuhlthau felt the affective experiences of information seekers had largely been ignored in information science research. When students came into her school library asking for information to begin a project, they were always feeling uptight and apprehensive. These feelings changed as students worked through their project. As a result of seeing this process in her school library, she decided to consider not only the more cognitive aspects of information seeking but also the affective aspects of doing a research project.

In more recent years, Kuhlthau and her colleagues (Kuhlthau, 1988a, 1988b, 1988c, 1988d, 1993, Kuhlthau, Turock, George, & Belvin, 1990; Loerke, 1994) have tested this model with various groups of users including junior high students, university students, adults and online-database information seekers. It has never been tested on CD-ROM encyclopedia information seeking.

Eisenberg and Berkowitz's Big Six Skills Approach (1990) was developed to meet the needs of students (See Table II) because "this explosion of information has serious implications for information seeking by all persons, but especially for students" (p. 6). The information problem-solving approach is flexible and can be applied in all information-seeking situations and is much more than just locating and collecting information.

Table II: The Big Six Skills

Task Definition Determining the nature of the information problem and defining the purpose for the information search
Information-seeking Strategies Determining the types of sources and strategies for acquiring the sources required to meet a previously defined information task
Location of & Access to Information Finding sources and retrieving specific information from sources
Use of Information Applying information to defined information needs
Synthesis Integrating, structuring, and repackaging information to meet defined task
Evaluation Judging the information problem-solving process and whether the information need was met

Source: Eisenberg, M. B., & Brown, M. K. (1990). Current themes regarding library and information skills instruction. In B. Woolls (Ed.), The research of school library media centers (p. 101). Castle Rock, Co: Hi Willow Research and Publishing.

The Big Six Skills approach is based on the work of Benjamin Bloom (1956) and his famous taxonomy of educational objectives. For Eisenberg and Berkowitz (1988), "Bloom's classification holds the basis for developing skill objectives that encourage students to think by teaching students to think" (p. 100). It would seem, to this researcher, that the first three skills would be especially important for information seeking in CD-ROM encyclopedias.

Brown stated "methods and criteria for selection or rejection of information vary in time, depend on immediate results, and are closely related to the personal habits of the searcher and the kind of needs which are to be satisfied" (p. 9). Brown's information-seeking model is based on the interaction of the self, the role and the environment, and these form the context. These three structures are the "backbone which supports the process of information seeking" (p. 10). The process begins with a gap in knowledge when a person decides to seek information. This model may be applicable to this research, as an electronic encyclopedia is simply one environment in which the self and role will interact.

Gross' (1999) work on the imposed query "emphasized that information seeking may be either self-generated (internally motivated by the personal context) or imposed (set in motion by someone else)" (p. 501). Her study took place in three elementary school libraries staffed with a professional librarian. She collected data from circulation transactions that involved a short interview with the user. The interview identified the transaction type (self-generated or imposed), the user's age, grade level and gender. If the transaction was an imposed query then the imposer was identified. The main imposers in the school environment were teachers, parents, children and the school library media specialist.

Gross presents a six stage model of the imposed query process; IQ_1 – Initiated, IQ_2 – Transferred, IQ_3 – Interpreted, IQ_4 – Negotiated, IQ_5 – Processed, and, IQ_6 – Evaluated. The model involves three people, the imposer, for example, a teacher, the agent, for example, the student, and, the intermediary, for example, the teacher-librarian. For Gross, "one of the key points made by the imposed query model is the idea that the process may be affected by feelings, beliefs, or both that the players in the process have about each other" (p. 505). This is in keeping with Kuhlthau's work. Gross presented the imposed query as a different way to look at information seeking.

Marchionini and Schneiderman (1991) combined the five critical components of their information-seeking framework into a model. The model was developed to guide both users and developers of hypertext systems. The *setting*, both physical and functional, constrains the search. For Marchionini and Schneiderman, "the setting helps delimit the task domain and motivate the user, and affects the selection and application of the search system" (pp. 250-251). *Task domains*, according to Marchionini and Schneiderman, "vary in complexity (number of entities and relationships), specificity (similarity of the entities and relationships), and evolutionary status (clarity of definition of the entities and relationships, and their rate of growth and change)" (p. 251). The *search system* is made up of the database, the interface and the organizational structure of the specific system. The search system that Marchionini and Schneiderman were specifically interested in was a full-text electronic encyclopedia.

The *user* in this information-seeking model is acknowledged to be unique. For Marchionini and Schneiderman, "a generic knowledge base of information-seeking experiences includes mental models for various search strategies, dynamic mental models for search systems, and a control mechanism for relating these internal representations to one another and to external entities" (p. 252). The mental models that each unique user brings to the information-seeking process are critical. Both products and processes are the *outcomes* of a user's information seeking. The products are the specific pieces of information that are seen by the user to satisfy the question or problem. These products can be evaluated for relevance or usefulness during the search or when the search is completed. The effectiveness and efficiency of the information-seeking process can also be evaluated. The experience of the process of information seeking can then become a part of the unique user's mental model to deal with future questions.

Marchionini (1992) proposed a five-process information-seeking model in his later research. In this model, "these functions are represented in a nonlinear way to suggest that although the overall process is iterative, the sequence of function calls may be opportunistic" (p. 157). The first and most important process in the model is the recognition and definition of the information problem, even though the problem will evolve throughout the information-seeking process. According to Marchionini, "whether the information problem is well defined or not, searchers must choose an information source to begin their search" (p. 158). When users articulate the problem, they must formulate a search strategy or search query that is dependent on the source. In computerized systems, the searcher is then presented with a number of hits or a record that matched the search query. For Marchionini, "because end users are ultimately concerned with primary information, display of full text or images is crucial to the examination of results" (p. 159). After selecting information that may be used to answer the original question, the searcher takes the information from the system in some way. This may be copying using pencil and paper, saving the information to a disk or printing the information. This model also focuses on the information seeker in an electronic environment and may provide a framework in which to place data from this research.

2.4 Information seeking in Electronic Environments

When computers first became a part of school libraries, they were used in several ways. The teacher-librarian might have used a word-processing package to create overdue slips and memorandums or a simple database program to keep track of overdue and lost materials. Later, a computer may have been used as an online public access catalogue (OPAC) to manage stock and circulation and to act as a catalogue for works contained in the school library. The teacher-librarian may have also been using a computer to access information from large online databases to answer questions needing up-to-date information. Soon after, a CD-ROM player might have been attached to a computer to allow searching of a full-text encyclopedia such as the Grolier Electronic Encyclopedia. Now students are accessing the Internet from their classrooms and school libraries and dealing with hypertext and hypermedia applications on websites.

Information-seeking research has focused on four types of information technology sources: online databases, OPACs, CD-ROMs, and most recently hypertext and hypermedia, including the Internet. It is interesting to look at these areas because some findings may apply to this research on CD-ROM encyclopedias. Searching for information in this complex information technology environment can be very difficult. It is especially difficult for novice searchers who have little knowledge about and experience with searching online (Tenopir, Nahl-Jakobovits, & Howard, 1991).

Some researchers (Borgman, 1989a; Fidel & Soergel, 1983) have looked at online information seekers and the factors that affect success. Fidel & Soergel (1983) discussed factors that may affect online searching. They created a conceptual framework based on the following eight variables of significance: "(1) the setting, (2) the user, (3) the request, (4) the database, (5) the search system, (6) the searcher, (7) the search process, [and] (8) the search outcome" (p. 164). The user is the person with an information need while the searcher is more specific and includes the characteristics of the user such as "personality traits, cognitive factors, demographic variables and education" (p.166-167). This research is interesting because it provides a framework for looking at variables of significance for success when using CD-ROM encyclopedias. It is also important for this study because of emphasis on the searcher's characteristics.

Other researchers have tried to determine what it is that novice users do when accessing information online (Bates, 1989; Fidel, 1984; Tenopir et al., 1991; Trivison, Chamis, Saracevic, & Kantor 1986). Tenopir et al. looked at academic end users as they searched a magazine database consisting of the text of articles from over 100 popular magazines. The case study method was employed as the researchers observed the search strategies of

11 participants as they accessed information from the database. The participants were given basic instruction and were encouraged to ask for help as they progressed through their searches. Tenopir et al. found that university staff, graduate students and undergraduate students stayed with search strategies they knew and had difficulty moving to or thinking of other strategies during the search process.

It also seems relevant to look at online public access catalogue (OPAC) research because "most libraries continue to build collections that are predominantly paper based [but] many have shifted to technologically based access to these materials" (Hooten, 1989, p. 267). The question for Hooten was to determine how "children and youth are affected by libraries' decisions to automate access to library holdings" (p. 268). Many children are confronted with quite different catalogue systems in their school and public libraries. It would seem, according to Hooten, that cognitive and sensorimotor skills needed to access information from traditional card catalogues and OPACs differ. This is also the case with print and electronic encyclopedias.

Solomon's (1993) study of the information retrieval behaviour of children using an OPAC found that with time and effort children met with success. Children asked for assistance from adults and other children when they were having difficulty and learned from their mistakes, for example, spelling, choice of search term. Solomon found that 66% of the information retrieval interactions were successful. Much of the success was the result of the terms selected that were quite simple and matched the subject headings used in the OPAC. "Conversely, the complex, abstract, idiosyncratic terms that children also employed were a major source of the breakdowns that children suffered in using the OPAC" (p. 259). It was found that children approached the OPAC with some knowledge of the rules for searching for information and that these rules became more advanced as they used the OPAC. It will be interesting to see if the same is true for junior high students searching CD-ROM encyclopedias.

For Marchionini (1991b), the more important development is that many primary information sources are now available in electronic form. One needs only to look to encyclopedias to see that almost all of them are now available on CD-ROM. After computers, CD-ROMs are the most used information technology tools in school libraries. Truett (1994) found that teacher-librarians in North Carolina reported that encyclopedias were the most useful CD-ROMs in the library. The study reported that encyclopedias on CD-ROM were the favourite in elementary and junior high schools while high schools made more use of indexes and abstracts.

Multimedia CD-ROMs have been described as compelling (McCarthy, 1993) and teachers and students use this technology for research in the school library (Pappas & Geitgey, 1994). The technology can help maintain interest so that complex conceptual learning occurs (Nash & Steadman, 1994). Students can explore and discover the information and are ultimately responsible for their own learning. A partnership between the teacher-librarian and the new technologies can help students develop problem-solving skills while searching for information. As a result, multimedia CD-ROMs provide opportunities and challenges for teachers and teacher-librarians.

Trotter (1993) proposed that "multimedia doesn't make schools different, but schools that become different can tap multimedia's full potential" (p. 20). Using electronic formats provides greater flexibility and allows for diverse strategies (Riding & Chambers, 1992). Perzylo & Oliver (1992) in their study found that students were able to navigate easily through a multimedia CD-ROM. Since multimedia CD-ROMs engage attention and require increased concentration, it is especially important that special needs students are exposed to the medium. Bankhead (1991) contended that these electronic formats enable special needs students to access information in the same way as other students. For Truett (1994), this technology is user friendly and meets the needs of young students. "Multimedia CD-ROMs have the capacity to directly influence the style of education and the types of skills emphasized in schools and the workplace far more than any other technological innovation" (Perzylo, 1993, p. 192).

Barker & Tucker (1990) pointed out that we have a weak foundation in the basic theory of how children relate to and make sense of multimedia. Since the technologies are still relatively new, we have no longitudinal studies examining how students' information technology processes develop from using the technology. Yildiz & Atkins (1993) reported that being positive and motivated to use the technology does not guarantee that learning will be improved. Pain-Lewins & Watson (1990a, 1990b) found that while students were motivated to use information technology, their lack of knowledge and skills in information handling caused problems. Laurillard (1995) cautioned that

> If that technological pull is not checked by pedagogical analysis of how best to support the children's work, then they may not be able to evaluate properly the information they retrieve, nor integrate the fragments of knowledge they end up with. The CD-ROM based encyclopedia does nothing to help with turning the information into knowledge. (p. 179-180)

Only the smallest libraries will still not have access to any kind of CD-ROM searching. As a result, Steadman, Nash & Eraut (1992) ask the important question - "Now that students have access to CD-ROM, do we really need to teach these [information] skills directly?" (p. 9). For many the answer is an unqualified yes (National Council for Education Technology (NCET), 1994; Pappas & Geitgey, 1994; Perzylo & Oliver, 1992; Small & Ferreira, 1994a). Not only do teachers and teacher-librarians need to teach these information-seeking processes; the processes are different from the ones being taught for accessing information from print sources. These skills must apply to non-text information - video, still photographs, graphs, maps, charts - as well as textual information on the computer screen.

Oliver & Oliver (1996) suggested that "students need new skills to make intelligent use of these new technologies" (p. 42) and the skills necessary are quite different from the ones needed when using traditional sources. The researchers also reported that these specific skills did not develop from personal exploration of the system. Oliver and Oliver proposed that "appropriate instruction in search strategies could help to create accurate mental models for users" (p. 43). New skills will be required to interact with electronic information systems. "Recognition of this and the adoption of appropriate strategies in places where information skills are taught and learned would appear to offer many advantages to all participants of the Information Age" (p. 43). They suggested the three main problem areas in the use of multimedia and hypermedia applications in schools and school libraries are disorientation, navigation inefficiency and cognitive overload. It will be interesting to see whether these three problem areas also present themselves in this study.

Some suggest that learner control can give novice users a sense of taking responsibility for their own learning, others believe that multimedia CD-ROMs provide problems for novice users. Without intervention by a teacher or teacher-librarian, Fidel (1991a, 1991b, 1991c) found that novice users lack the ability to form effective search plans and to select correct search keys. Trumball, Gay and Mazur (1992) stated that novice users "have only impoverished strategies for synthesizing data into patterns" (p. 315). Oliver & Oliver (1996) in their study of CD-ROM encyclopedias found that each student had a preferred strategy that they used because of ease of use rather than type of information task. Pappas & Geitgey (1994) observed that novice user's information-seeking strategies may be at any point on the simple to complex continuum. Most students left to their own failed to progress to a more analytical search strategy.

Marchionini (1989b) contended that users of information technology are required to deal with finding too much information and so need different skills to deal with refining and selecting appropriate articles. New questions and problems arise when considering whether finding more articles leads to more information or more frustration for the novice user. Less proficient, less able students are particularly at risk because they may miss important information or exit the program too soon (Chen, 1990-1991). McGrath (1992) stated that research has generally found that novice user learning is less successful with program control. By their very nature, interactive CD-ROM applications provide the highest degree of learner control possible (Perzylo & Oliver, 1992).

Hypertext was built on the idea that learners should be able to move about on an electronic resource by selecting links to other relevant pieces of information. However, for McGrath (1992), "one of the most critical questions we need to answer is whether and under what conditions learners benefit from having all those choices available during the learning process" (p. 513). Her study of undergraduate students added some more evidence that students of differing abilities perform differently in a hypertext environment. Pappas & Geitgey (1994) observed students interacting with CD-ROM encyclopedias and noticed that students did not make use of all of the features, for example, they did not use the note-taking facilities provided. Perzylo & Oliver (1992) reported that students did not tend to use all the information from the screen and did not make effective use of the various media features.

Research has indicated that novice end users may lack the expertise necessary for successful information interactions (Trumbull et al., 1992). Large & Beheshti (2000) found that "despite some initial training, the students encountered a variety of problems" (p. 6). Their skills did not improve with practice, selection of search terms remained constant, and their strategies did not change over time.

A study by Large, Beheshti, Breuleux and Renaud (1994b) looked at whether multimedia encyclopedias enhanced learning. The researchers found that subjects using a text-only version of the CD-ROM encyclopedia had better literal recall than subjects using a text and illustrated version or a multimedia version of the CD-ROM encyclopedia. Small and Ferreira (1994b) tried to answer research questions specific to the similarities and differences between students' information-seeking skills for print and electronic encyclopedias. The researchers found that students using a print encyclopedia spent more time extracting and recording information while students using an electronic encyclopedia "performed more finding and engaging activities" (p. 102). Students in the study also believed that the information from the CD-ROM encyclopedia was more credible than the information in the print encyclopedia.

Gross (1999), in her study of imposed queries in three school libraries, found that "in using resources, students had trouble finding answers when they had to search through a lot of text [and] when the resources did not use the same terminology they were given in class" (p. 513). She also noted that children had difficulty in determining what a right answer was when dealing with textual information. "Children who are able to accept the imposed query as their own and feel their honest response will be accepted will voluntarily engage in the process, have a positive experience, and will be unlikely to invoke a need to emphasize the imposed nature of the situation" (p. 518). Participants in the study reported that they seek help from other classmates who have special skills.

Hirsh (1999) explored the relevance criteria and information seeking of ten fifth-grade children using the OPAC, the Internet, World Book Encyclopedia, and SIRS magazine index. At home, most of the children had Internet access and all had access to a CD-ROM encyclopedia. Half of the students used the home computer for homework but "home computers were mostly used to play games" (p. 1269). Participants reported that "they did frequently rely on their teacher, librarians, and peers for help in finding information" (p. 1270). Librarians were asked for help with search terms, search strategies and locating materials. According to the researcher, students searching electronic encyclopedia "became frustrated when the displayed results did not match what they expected to see" (p. 1270). Hirsh found that "although students appeared to be comfortable searching this system, they were not always successful in the search strategies they applied" (p. 1271). Participants "did not make use of advanced search features, and did not use navigation features" (p. 1278). Hirsh's findings suggested "that students could benefit from additional training in how to search and navigate electronic resources that they are likely to use" (p. 1278). She also noted that participants did not clearly understand the nature of or how to search each of the electronic resources.

Fidel et al. (1999) studied searching behaviour of eleventh- and twelfth-grade high school students on the Internet. The first finding was that "searching was both a social and academic event" for the students (p. 28). This involved both giving advice and asking questions and was encouraged by the teacher. Fidel et al. stated that the "interchanges covered many aspects relating to searching, ranging from technical pointers to tips about searching to interpretations of the questions in the assignment, and all intertwined with social intercommunications, mostly verbal, typical of students their age" (p. 28).

The researchers reported several common patterns that may apply to the findings of this research. The first pattern, called focused searching by the researchers, indicated that students' "purpose was to find lines on the screen that would answer the questions in the assignment" (p. 28). The second pattern, swift and flexible searching, suggested that "searching for information involved much clicking and moving swiftly from one site to another" (p. 29). Another interesting pattern was that student felt like they could always start a new search when no satisfactory results had been located. Another pattern, not surprisingly, was that "students actively and constantly asked for help from the teacher, the librarian, and their classmates" (p. 30). Interestingly, students tended to ask whomever was closest to them for assistance.

Fidel et al. also reported the students' opinions about the web. For students, the Internet was appealing because of the speed of locating information. Therefore, when the Internet failed to produce results quickly, students became frustrated. They were also frustrated when they felt like they had spent a reasonable time and could not locate information.

Bilal (2000) reported the results of the first part of a research project that looked at 22 grade-seven students' use of the Yahooligans! Web Search for fact-based search tasks. The question that students were trying to answer was "How long do alligators live in the wild, and how long in captivity" (p. 649). The data was gathered using both qualitative and quantitative inquiry methods. Bilal recorded the searches using Lotus Screen Cam and "developed three instruments: 1. Internet/Web Quiz, 2. Exit interview, and 3. Teacher Assessment of Student Characteristics" (p. 648). She was interested in the cognitive, physical and affective behaviours of the students. In her results, Bilal reported that most of the participants typed in *alligator* or *alligators* as their initial search term. One used the search term *alligators in the wild*. She also found that "successful children formulated their searches using either single or multiple concepts, whereas unsuccessful ones employed these kinds of concepts in addition to natural language phrases" (p. 656). Yahooligans! does not support natural language searching.

Scrolling, use of the back button, and navigating links were three important physical behaviours that all students used. The back button was used by students when they were lost (p. 655). Bilal reported that "in general, children did not scroll long screens as fully as they did short ones" (p. 655). One very interesting finding was that "children's domain knowledge, topic knowledge, and reading ability did not significantly influence their success" (p. 659).

Miller & Olson (1994) stated that central to the whole issue of successful use of information technology by students is the attitude of teachers and teacher-librarians toward technology. Herring (1992) proposed that the use of information technology in schools is mainly the result of individual teachers who are interested in the technology. Miller & Olson's research suggested "the computer environment is a consequence of teacher intention – its place in the scheme of the classroom is constructed by the teacher and the student" (p. 137). So, it seems that the teacher-librarian and teacher play an important role in student success with information technology. The research in information seeking in electronic environments suggests there is still much to learn about this complex phenomenon.

2.5 Schema Theory and Mental Model Theory

The word "schema" has a long history. According to Marshall (1995), "the word and the concept it reflects are prominent in the writings of the ancient Greek philosophers" (p. 3). Marshall described in her work, Schemas in Problem Solving, the use of the concept over the years by Plato, Aristotle, Kant, Piaget and Bartlett. She described a schema as

> A mental structure centered on an event, situation, experience, or object. It may or may not require action (Piaget says yes, but the philosophers seem to say no). It organizes past experiences in such a way that their features are noted and retrieved to interpret a current instance. It has some definite form or shape, because it can contribute to distortions of recollection, but very little has been said about what that shape might be. (p. 16)

Rumelhart's work on schema is the most relevant to this particular study. Rumelhart (1980) proposed that schemata are the "building blocks of cognition" (p. 33). Information processing depends upon schemata. For Rumelhart, "schemata are employed in the process of interpreting sensory data (both linguistic and non-linguistic), in retrieving information from memory, in organizing actions, in determining goals and sub-goals, in allocating resources, and generally, in guiding the flow of processing in the system" (pp. 33-34).

A schema theory, then, is "basically a theory about knowledge" (p. 34). It is a theory that describes how knowledge is organized and represented and used. Schemata act as structures to represent all concepts and as links to all other concepts. Schemata are not static processes. As new information is gained, schemata reorganize themselves to better represent the new knowledge. Rumelhart listed the six general features of schemata,

1. Schemata have variables.
2. Schemata can embed, one within another.
3. Schemata represent knowledge at all levels of abstraction.
4. Schemata represent knowledge rather than definitions
5. Schemata are active processes

6. Schemata are recognition devices whose processing is aimed at the evaluation of their goodness of fit to the data being processed. (pp. 40-41)

According to Marshall, there is still much research to be done in the area of schema theory. She suggested that researchers "have taken schemas as given, and few have dealt with issues having to do with schema creation or modification" (p. 31). Rumelhart acknowledged that schema theory was still in infancy but suggested that researchers "try to apply psychological theories directly to domains relevant to education" (p. 57).

Mental models, according to Tallman and Henderson (1999), "can be defined as schema or internal domain-specific representation of an object, system, or event that may be incomplete" (p.1). The terms mental model and schema are used interchangeably in the Tallman and Henderson (1999) research. Borgman (1982) described the mental model as "a representation of the relationships within [a] system" (p. 38). In a later article, Borgman (1986b) noted that mental models are "dynamic" (p. 48). She expanded her earlier definition to include the ideas that the mental model "represents the structure and internal relationships of [a] system and aids the user in understanding it, making inferences about it, and predicting [a] system's behaviour in future instances" (p. 48). Mitchell and Dewdney (1998) noted "the term mental model generally refers to a working model of the system (or of the world) that individuals construct in their minds to facilitate interaction with the environment, other individuals, or technology" (p. 275). Though mental models and schemata have much in common, I do see some differences. Mental models are much more procedural in nature. They can be depicted as flowcharts while schemata can be depicted as web diagrams.

Ayersman and Reed (1998) discussed four types of information structures, also called mental models, that apply both to hypermedia and to an individual's ability to mentally organize information. Semantic networks, the first type, are organized with few inter-connections in a hierarchical structure. The second type, concept maps, according to Ayersman and Reed, "allow information to be intertwined and interconnected in a nonlinear fashion that is typically represented as extending from the center outward" (p. 223). Frames, or scripts, the third type of information structure, are "analogous to frames of video [and] these information structures also combine to form scripts just as frames of video combine to form movies – a series of still events that, when played in sequence, represent action" (p. 223). Schema is the fourth type of information structure. Schemata are uniquely personal and can encircle the other three types of information structures.

2.6 Schema and Mental Models in Electronic Environments

There has been much interest about mental models in research in the field of human-computer interaction. Research has been done in the areas of online information seeking in library catalogue databases (Borgman 1986b), electronic encyclopedias (Marchionini, 1989a, 1989b), and hypermedia (Ayersman & Reed, 1998). Mitchell and Dewdney (1998), in their overview of LIS research, found an increase in research involving mental models. The authors cited the work of Liebscher and Marchionini (1988) who studied students' mental models when using a full-text CD-ROM encyclopedia. They summarized four findings relevant to this study. The first finding was that searching was more effective when the mental model and the conceptual model were close. However, the second finding was that incomplete mental models allowed the user to function adequately. Mitchell and Dewdney's (1998) third finding noted that "different types of tasks required different types of training" (p. 277). The fourth finding comes from the work of Marchionini and Liebscher (1991) who found that mental models of print encyclopedias did not necessarily translate into mental models of electronic encyclopedias.

Marchionini and Liebscher studied undergraduates as they searched both print and electronic encyclopedias. This study was a part of a series of investigations that examined how users "develop mental models for new information retrieval systems in general, how these new mental models affect users' information-seeking mental models in particular, and how designers can use this knowledge to design effective systems" (p. 39). The researchers were interested in the relationship between cognitive load, the amount of mental energy needed to perform a certain task, and mental model development. Marchionini and Liebscher believed that "the dual concepts of mental models and cognitive load seem, therefore, to be closely bound" (p. 39). They found that students "took less time, executed fewer queries, and examined fewer articles in the print encyclopedia" (p. 43). The authors then argued that mental models played a part in the results of the study. Print encyclopedia searching took less time and was more successful because the students had a well-established mental model. Students searching electronic encyclopedias, on the other hand, did not have a well-established mental model and so their cognitive resources were split in three ways:

> First, some cognitive load had to be given to adapting, developing, and refining their emerging mental models for the electronic search system. Second, the task of searching two of the electronic encyclopedias was conceptually more complex than the print encyclopedias because these systems require additional discrete and explicit decisions to be made by

> presenting sets of retrieved articles. Third, whatever remaining cognitive resources are available are allocated to the search task. (p. 44)

The above research was very interesting in that it demonstrated that mental models can play an important role in looking at how people interact with electronic encyclopedias. As this research was done almost a decade ago, it will be important to note whether students' mental models of CD-ROM encyclopedias are now better established.

Borgman (1986b) used mental model theory to study how undergraduate students interacted with an information retrieval system, in this case an online catalogue. Borgman attempted to train half of the students to give them a mental model of the system to see if they would perform better in searching that system. The other students were given procedural training in the system. Borgman found that there was no significant difference between the two groups on simple tasks but found a significant difference in more complex tasks. She noted that "perhaps the most important finding from this experiment is not the mental models result but the likelihood of individual differences in the ability to use this particular technology" (p. 61).

Ayersman and Reed (1998) used four mental models or information structures as a basis for the study of undergraduate students working in a hypermedia environment. The researchers suggested that "the fact that all significant relationships found for hypermedia knowledge growth were positive might indicate that as students gained hypermedia knowledge, they concomitantly became more able to apply the four mental models" (p. 232). Ayersman and Reed determined that a better understanding of hypermedia environments was gained by the use of the four mental models. It is interesting to look at the variety of research in the area of mental models. An individual's mental models can play an important part in their information-seeking processes.

2.7 Reading Theory

When anyone interacts with CD-ROM encyclopedias, a certain amount of reading will occur. To better understand what might be an important part of the information-seeking processes of junior high students, it is interesting to look at reading research. Many theories and models try to explain what happens when an individual interacts with text. For Cross and Paris (1988), "theoretical accounts of reading have progressed from simplistic linear models of decoding to complex models of reading that include interactive and compensatory components for constructing meaning from text" (p. 131). For this research, I looked at some of the work of Rumelhart, who proposes an interactive model of reading, and Ruddell and Speaker. These works present an interesting starting point for looking at reading in electronic environments.

Rumelhart (1977) presented an interactive model of reading to accommodate syntactical, semantic, orthographic and lexical knowledge. He felt that the linear models had difficulty accommodating all of the occurrences that may take place when an individual reads. Rumelhart's (1985) model "makes use of a formalism allowing highly interactive parallel processing units" (p. 723).

A very interesting model of reading came from Ruddell and Speaker (1985). They offered an interactive reading process model containing four components. The "*Reader Environment Component* of the model includes the immediate textual, conversational, and instructional features used by the reader in constructing meaning from text" (p. 751). This component could also be applied to hypertext and the multimedia features of a CD-ROM encyclopedia. The *Knowledge Utilization and Control Component* deals with the individual reader's affective, cognitive and metacognitive states. This involves the goals, the expectations of the content, the amount of time, the plan of action, the monitoring, and the evaluation of the reading. This component also includes the text representation. According to Ruddell and Speaker, the text representation is the reader's interpretation of the text meaning and the record of the text processing to a given time" (pp. 751-752). The *Declarative and Procedural Knowledge* component of the model contains the "reader's store of schemata related to Decoding, Language, and World Knowledge and the procedures for using these knowledge forms" (p. 751).

This idea of schemata's role in reading comes from Rumelhart (1981). The interaction of the *Reader Environment*, *Declarative and Procedural Knowledge*, and *Knowledge Utilization and Control* results in the *Reader Product*. Ruddell and Speaker list eight products: Comprehension, Word Recognition, Oral Output, Written Output, Affective State Change, Cognitive State Change, Metacognitive State Change, and New Knowledge (p. 753).

This model of reading seems to contain similar elements to many of the information-seeking process models. A concern for cognitive and affective states mirrors the work of Kuhlthau (1991) and Tenopir et al. (1991). Marchionini and Schneiderman's (1991) information-seeking model would also fit into the components of the model. Rumelhart's (1981) work on schemata is also included in this model. Ruddell and Speaker (1985) suggested that phenomenalistic research is a way to capture the complex nature of reading in electronic environments.

2.8 Reading in Electronic Environments

The previous theories and model dealt with reading in a print-based culture. However, readers are no longer limited to the printed page. In fact, more and more reading and writing is being done electronically. According to Snyder, there are basic assumptions about print-based reading that no longer apply to electronic or hypertext reading. She suggested that print-based reading is still mainly linear, predictable, based on reading from other texts, and stable as an object, for example, a bound book. The assumptions about the nature of reading in electronic environments are quite different. Snyder suggested that reading in hypertext "is not assumed to be sequential and continuous but discontinuous, nonlinear and associative, like the process of thinking" (p. 69). Readers in hypertext have more choice and are actually a part of the text.

Selfe (1997) argued that the standard rules that govern paper-based texts are different than those on a computer screen. Individuals are able to predict some things about paper-based texts that they read and write based on the arrangement, structure, form, and appearance of text (p. 2). If we think about a book, for example, "it is composed of a predictable set of structural components, consisting of letters that combine into words, words that combine into sentences, and sentences that add up to paragraphs, pages, sections, and chapters" (p. 2). Selfe described some of the formal conventions of a page of text:

- Running headers
- Numbers
- Standard margins on the sides and at the top and bottom
- Footnotes
- Titles
- Subtitles
- Headings
- Made of paper
- Bound
- Ratio of width to height is approximately 2 to 3. (p. 2)

These are the static units of text that do not change from reading to reading. For Selfe, these "conventions that we learn during our literacy training allow us to 'cope' with the world of print, to anticipate the characteristics that printed texts share, and thus to use these texts efficiently" (p. 2).

Selfe suggested two ways that the use of computers might affect literacy. The first is that computers add conventions. Individuals must learn to be literate in this environment. Second, "some of the conventions associated with computers do not exist in the natural world, and these conventions change the way in which we think about communication problems" (p. 3). Virtual texts do not represent a "page" of text. A reader of hypertext lacks some of the spatial-contextual clues that are available to a reader of a paper-based text. (p. 3). When reading a book, an individual at one glance can determine many things about the text including length, organization and format. On the other hand, in hypertext, the reader cannot see the whole text. Instead they must keep track of individual screens in their mind and create a picture of how the text is put together (p. 3). This is more difficult and may result in slower or more erratic movement through the text. Screens "are not numbered; their margins are fluid and easily modified by writers and readers; the aspect ration of screens, at 4 to 3, mimics that of a television rather than of most books" (p. 4). Screens have other characteristics not shared by pages. These include:

- Cursors
- Windows
- Menu lines
- Glass or plastic screens
- Need a power source
- Text consists of phosphorescent pixels. (p. 4)

The differences between print and computer conventions provide an interesting starting point when considering some of the needs of novice users in their development of electronic literacy.

In hypertext as in print, readers can begin at any point in the text, move through the text in an individual way, and leave the text at any point. Kumbruck (1998) noted that "while the elements of the content are not affected by this process, the reader generates the structure of the hypertext" (p. 163). The reader, then, is an active participant in the creation of a uniquely individual text. For Reinking (1987), "unlike conventionally printed text, which is subject to the technological limitations of the page, text mediated by a computer represents a technology that approaches the flexibility and complexity of human information processing" (p. 3). It will be interesting to see how junior high students actually read while searching and to see if their reading is different in a CD-ROM encyclopedia.

Research on reading in electronic environments may provide some interesting ideas to think about in relation to information-seeking processes. A study by Anderson-Inman, Horney, Chen and Lewin (1994) looked at hypertext reading of a short story by students in the middle grades. The hypertext short stories included enhancements - referred to as resources in the article – and were of two types. The first type focused on comprehension and included definitions, fact questions and graphic organizers. Enhancements to improve active reading skills and appreciation of the author's craft, the second type, included thought questions and note-taking options. "A close review of the transcripts resulting from the computer monitors revealed at least six distinctly different ways in which students interacted with (read) the ElectroText versions of existing short stories" (p. 283). They called these hypertext-reading patterns and described them as follows:

- Skimming: Moving through the text at a pace too fast for reading or studying.
- Checking: Moving through the text and/or resources systematically, apparently checking things out, but not reading or responding.
- Reading: Visiting text pages for periods long enough to read the material but with little or no use of the resources.
- Responding: Accessing resources, but not in a way that appears related to reading the text.
- Studying: Moving through the text pages systematically, visiting pages long enough to read them, and using resources in an integrated manner.
- Reviewing: Rereading the text and/or accessing the available resources a second time. (p. 283)

These patterns of adolescent hypertext reading are very interesting and may provide yet another framework for the data in this study.

The researchers also discovered three profiles to describe adolescent hypertext reading. Book lovers, the first according to Anderson-Inman et al., "accessed some of the resources when beginning to read a story, but resource use trailed off quickly; and they tended to move through the story in a fairly linear manner, reading one page after another" (p. 284). This group of readers preferred books to reading on the computer screen. Studiers took advantage of the resources and features of the hypertext short story throughout the story. They provided much better retelling than the book lovers group and had a positive attitude toward reading on the computer screen. Anderson-Inman et al. noted that the studiers "were serious users of the system, adopting reading patterns that were both interactive and integrative" (p. 284). The final profile was the resource junkie. These adolescents became so caught up in the resources that they failed to read and understand the story. This group spent time listening to the pronunciations of words, sometimes listening to a sound byte more than 40 times. For Anderson-Inman et al., "resource junkies were unable to provide adequate retellings but were nonetheless positive about using the computer to read stories" (p. 284). The question of whether these three types of readers will also apply in a non-fiction electronic environment is an important one for this study. It will also be interesting to see whether the resource junkies simply fade away after some experience with hypertext.

The researchers also identified three types of reading skills that were effective in this specific hypertext environment. Anderson-Inman et al. felt that students must have "a mental model of the information in the hypertext document and an understanding of how or why the information is chunked as it is" (p. 285). They called this knowledge of the document structure. The research indicated that adolescents needed to engage the text and its various enhancements with a sense of purpose. Successful hypertext users were able to use available resources at appropriate times when working through the text. The researchers also felt that students required a multiphasic approach to reading. These skills fit well into the Ruddell and Speaker (1985) model of reading. As students worked through the text they needed to make decisions to help increase their comprehension. This study focused on hypertext literacy in a fictional text. The text did not include the multimedia features of a CD-ROM encyclopedia but the hypertext reading strategies and profiles are indeed interesting.

Slatin (1990) also presented three types of hypertext readers. He called them browsers, users and co-authors. Browsers wander through the text and read for pleasure and are unlikely to go through all the material. The user is " a reader with a clear – and often clearly limited – purpose" (p. 875). Users access the system to locate specific information and then leave it. The co-authors become actively involved in the hypertext. They may even create new nodes or new links in the system. These types of readers may also exist in hypermedia environments such as electronic encyclopedias.

Reinking and his colleagues (Reinking, 1987, 1994; Reinking & ChanLin, 1994; Reinking & Rickman, 1990) have looked at how electronic texts may change ideas about literacy and education in the future. Reinking (1994) argued that although readers and printed text do interact, it is not a literal interaction. Readers and electronic texts, on the other hand, can indeed interact. He noted that "electronic texts can be programmed to adapt to an individual reader's needs and interests during reading, which may in turn affect the strategies readers use to read and comprehend texts" (p. 3). Reinking and Rickman (1990) studied a group of middle-grade students reading electronic text with the definitions of difficult words available to them. Another group of students was given the print version of the text along with a print dictionary. The results suggested that students using the interactive computer texts looked up more definitions, recalled the definitions of more words, and had better comprehension of the text.

Reinking and ChanLin (1994) studied "informational graphic aids such as pictures, illustrations, diagrams, charts, tables, maps and similar visual representations used in conjunction with written prose for the specific purpose of aiding understanding" (p. 208). The researchers used a framework that identified four differences between electronic and printed texts.

> 1. Control/ Access: Electronic texts can control readers' access to text during independent reading.
> 2. Interaction: Electronic texts permit readers and texts to interact in a literal as opposed to a metaphorical sense.
> 3. Structure: Electronic texts may be structured differently than printed texts.
> 4. Symbolic Representation: Electronic texts make available a wide range of symbolic elements that can be integrated with prose. (p. 216)

They found that electronic texts "blur the distinction between written prose and graphical representations" (p. 228). The authors challenged researchers to look carefully at electronic texts to determine how graphic aids and prose can be combined to produce the best learning environment. Reinking and his colleagues presented some interesting ideas that need further study and careful research in order for a better understanding of reading in hypertext and hypermedia to be gained.

2.9 Children and Adolescents as Information Seekers

Research on the information-seeking behaviour of children and adolescents is limited. According to Chelton and Thomas (1999),

> One of the challenges of teaching graduate students to work with children and youth in school and public libraries is to inform their approaches to instructional design and their understandings of how people use information technology through an examination of current research. The problems in so doing have been exacerbated by the scare, fragmented, and sometimes flawed nature of past research in information and library studies dealing with youth issues in information seeking. (p. 7)

Research using adolescent participants can help to inform not only those who work in school libraries and young adult departments of public libraries but also those who serve adults. For Chelton and Thomas, "considering the problems of youth in navigating increasingly sophisticated searching environments may be helpful to system designers, at the same time that they serve as cautionary guideposts to those who may have forgotten the problems that exist for novice users of all ages" (pp. 7-8). Of course, junior high students are an interesting population all on their own. Their need for information for projects and personal enjoyment becomes very important at this stage of their school life.

Schools of Library and Information Studies and Faculties of Education tend to use more easily available participants such as university undergraduates, graduate students or faculty and staff members. However, some of the research studies relevant to this problem have used younger participants. Kuhlthau (1983), in her dissertation research, used participants who were gifted high school students. Pitts (1994) used a class of grade 11 and 12 science students who were working on a video documentary as her participants. McGregor (1993) also used high school students as her participants. Her research looked at information seeking by students when working on English and Social Studies research papers.

Children and adolescents have been used as participants when looking at information seeking in electronic environments in several relevant research studies. Liebscher and Marchionini (1988) used a class of 26 grade nine students with no CD-ROM experience in a study of browsing and analytical search strategies using a full-text electronic encyclopedia. Borgman and her colleagues (Borgman, Hirsch, Walter and Gallagher, 1995) have spent many years working on The Science Library Catalog Project. The project has involved studying a variety of children, in this study aged 9-12, and how they use an online public access catalogue. Perzylo and Oliver (1992) looked at the information-seeking strategies of 32 final year elementary students as they searched for information on National Geographic Mammals Multimedia Encyclopedia. Large and his colleagues (Large & Beheshti, 2000; Large, Beheshti & Breuleux, 1998; Large et al., 1994a, 1994b; Large, Beheshti, Breuleux & Renaud, 1995; Large, Beheshti, Breuleux & Renaud, 1996; Large, Beheshti & Moukdad, 1999) have focused much of their research on grade six students in suburban Montreal.

Anderson-Inman and her colleagues (Anderson-Inman et al., 1994) conducted a study of the ElectroText project at a middle school (grades 6-8) in Oregon. The participants were at-risk students who interacted with hypertext short stories. Davidson-Shivers and her colleagues (Davidson-Shivers, Shorter, & Jordan, 1997) used high ability/high verbal grade five students to look at learning strategies in a hypermedia environment. Bilal and her colleague (Bilal, 1999, 2000; Bilal & Watson, 1998) used grade seven science students as participants in their study of Internet searching. Schacter, Chung and Dorr (1998) also looked at Internet searching. Their participants were 32 grade five and six students from a school in California. Akin (1998) used 265 fourth and eighth graders as participants to look at information overload.

There is a body of literature that can provide support for the use of children and adolescents as participants in the study of information seeking. Children and adolescents are an interesting population to study and the research described has contributed greatly to our overall understanding of how children engage in information seeking and learning.

2.10 Chapter Summary

This chapter reviewed the literature relevant to the information-seeking processes of junior high students as they access information using CD-ROM encyclopedias. The nine student standards in Information Power provided a clear picture of the importance of information literacy for life-long learning. The work of Brown described the move from document-oriented models of information seeking to the latest trend of user-oriented models. Bates' berrypicking model is one example of this trend. She proposes a model that information seekers gather bits and pieces of information in a berrypicking manner. Kuhlthau's Information Search Process model focused on the user as well and included affective, cognitive and physical aspects of the whole information-seeking process. Eisenberg and Berkowitz's Big Six Skills approach is a further example of a user-oriented approach to information-seeking. Gross introduced the imposed query to information seeking theory. This theory identified that information seekers can have two types of information queries. The first is self-generated and the other is imposed by others, for example, teachers and teacher-librarians. Marchionini and Schneiderman proposed a model to be used as a guide for users and for those interested in the development of hypertext systems.

The literature about information seeking in electronic environments was an important part of this review. Children and adolescents have been used as participants in studies about information seeking (Anderson-Inman et al., 1994; Kuhlthau, 1983; Large & Beheshti, 2000; Marchionini, 1989a, 1989b; McGregor, 1993;). Researchers found that searchers tended to stay with search strategies they knew and had difficulty moving to other strategies (Hirsh, 1999; Fidel, 1991a, 1991b, 1991c; Large & Beheshti, 2000; Oliver & Oliver, 1996; Pappas & Geitgey, 1994; Tenopir et al., 1991). Children and young adults ask for assistance from others when searching (Fidel et al., 1999; Hirsh, 1999; Solomon, 1993). Searchers tend to use simple terms, terms from the question, or the complete question as initial search terms (Bilal, 2000; Solomon, 1993). Researchers also found that searchers became frustrated when selecting articles from a long list or when the results were not as anticipated (Fidel et al., 1999; Marchionini, 1989a).

Researchers suggest that a searcher's mental model of the system may influence their information-seeking behaviour (Marchionini & Liebscher, 1991). Several theories of reading contain elements that are similar to the information-seeking theories (Ruddell & Speaker, 1985; Rumelhart, 1989). Reading in electronic environments may be different than print-based reading because the conventions of screen and print are different (Selfe, 1997). Researchers report that there are patterns of hypertext reading such as skimming, checking, reading, responding, studying, and reviewing (Anderson-Inman et al., 1994). There are also profiles to describe hypertext readers including; book lovers, studiers, and resource junkies from Anderson-Inman et al. and, browsers, users, and co-authors from Slatin (1990). Reinking and his colleagues suggested that readers and electronic texts can interact.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This research was conducted within the qualitative paradigm as it is concerned both with process and meaning. For Merriam, "qualitative research assumes that there are multiple realities – that the world is not an objective thing out there but a function of personal interaction and perception" (1988, p. 17). A qualitative researcher stresses "the socially constructed nature of reality, the intimate relationship between the researcher and what is studied and the situational constraints that shape inquiry" (Denzin & Lincoln, 1998, p. 8). As a result, the qualitative researcher is the primary instrument for data collection, analysis and interpretation (Creswell, 1994). Qualitative researchers use this data gathered in the field to build up hypotheses, concepts, abstractions and theories. In this way the work is inductive rather than deductive. The researcher in the qualitative paradigm is involved in fieldwork and uses multiple methods to gain an in-depth understanding of the research problem and the specific research questions. Qualitative research describes the research context as well as the meaning and process.

The use of multiple methods will add "rigor, breadth and depth to the investigation" (Denzin & Lincoln, 1998, p. 4). These multiple methods, Think Alouds, Think Afters, observation, interviews and videotapes of the search, will be set within a case study framework. This research will looked at a single case, that of junior high students at Samuel Hearne Secondary School in Inuvik, Northwest Territories. There was direct contact with the situation and the people in a natural setting. This study was well suited to this paradigm as there is a need for theory and description of the information-seeking processes of junior high students using CD-ROM encyclopedias. The thought-processes and in-depth personal discussions needed to gain an understanding of this phenomenon are well suited to the qualitative research.

This chapter presents, in detail, case study as a framework for the study as well as a more detailed discussion of data collection and the multiple methods used. Within the sections on verbal protocol analysis, interviews and observation, a brief description of related literature is included. Also important is a discussion of the selection of participants and key informants and the ethical considerations important for the care of those involved in the research. Data analysis procedures make up the final part of this chapter.

3.2 The Role of the Researcher

In qualitative research, the role of the researcher is pivotal. According to Stake (1995),

> The case researcher plays different roles and has options as to how they will be played. The roles may include teacher, participant observer, interviewer, reader, storyteller, advocate, artist, counselor, evaluator, consultant and others. Although the rules of research oftentimes seem prescribed and restrictive, the styles researchers follow in designing, studying, writing, and consulting vary considerably. Each researcher consciously or unconsciously makes continuous decisions about how much emphasis to give each role. (p. 91)

Since interpretation is involved, it is important to provide background information about me and my place within the research setting. I acted as a teacher and teacher-librarian in the setting for six years. As a result, I had a good deal of familiarity with school staff, school administration, board office administration, District Education Authority members and the community of parents and students. I was familiar with the use of CD-ROM encyclopedias in both the classroom and the school library setting. Although I did not teach any of the participants, most of them knew me in some way. I had taught brothers or sisters, cousins, aunts and uncles of the participants.

There were many steps necessary to gain entry to the research setting. For this study, the first step was to apply for research permission through the University Standards for Protection of Human Research Participants (Appendix A) established by the University of Alberta. Approval was received on August 1, 1999 (Appendix B). Next, permission using Doing Research in the Northwest Territories: A Guide for Researchers was gained through the Aurora Research Institute, Aurora College (Appendix C). Permission was granted on September 14, 1999 and a research license was issued (Appendix D). This process included securing permission for this study from five stakeholders in the community – the Gwich'in Tribal Council, the Inuvik Community Corporation, the Inuvik Town Office, the Inuvik District Education Authority and the Beaufort Delta Education Council.

The research was presented at the first staff meeting after I arrived in Inuvik. I explained what would be happening over the next eight weeks and asked for their support and understanding. I arranged to meet with the three core teachers to identify possible participants. After the staff meeting, key teachers within the school were asked formally to participate in the research (Appendix E). They were asked to complete a consent form if they were willing to participate (Appendix F). Four members of the school community were willing to participate. Several others were willing but felt that they had little insight to share as they had never used technology with their students, for example, Native Language teachers and the Physical Education Teacher. It was determined that the Principal and Assistant Principal would not be asked to be key informants as they were both new to the school and to the Northwest Territories as of September 1999.

Student participants in the classes were identified the day after the staff meeting. Meetings or phone calls with the parents of possible participants took place over the next several days. It was essential to have the support of teachers, administration, parents and community members for this research to begin. I spoke with parents and community members in informal ways, for example, on the telephone, at a wedding, at the grocery store, at church, on the street and in the school. They all expressed support for the research.

With the permission of parents and teachers, selected students were brought together as a small group so that I could explain the research project to them. We met in the research study room so that I could show them what the space would look like when they came to do their interviews and search sessions. I encouraged them to ask questions and to think about whether they were interested in participating. Ten of the initial twelve students decided to participate. Two decided against participating even though their parents were willing to allow them to participate. Their teachers then selected two more students and their parents were contacted. These two students decided to participate so that I had twelve participants, four in each grade. After meeting with students, an envelope of information was sent home to the parents. Included in the package was a formal letter of introduction to parents (Appendix G), a letter of consent for participants (Appendix H), a letter of permission for parents (Appendix I) and a copy of the research license. All of the permission and consent letters were returned to me by the participants or their parents within the next few days.

3.3 Case Study

The case study is only one of many ways to approach research in the social sciences. For Yin (1989), case studies are used when the research question is contemporary and focuses on the "how" and "why". Where the focus is on the real life situations and where there is little or no control over the events, a researcher may choose case study as the framework. For Merriam (1988), a case study is a way to study a phenomenon in a systematic way.

Case study was selected for this research because this case, as Merriam suggested, was "intrinsically interesting" (p. 10). Within Samuel Hearne Secondary School there is a diverse student population including Aboriginal students of Gwich'in, Inuvialuit, and Cree heritage and Non-Aboriginal students from a variety of ethnic backgrounds. The school provides a bounded system and it was chosen because of its uniqueness in location (Western Arctic), diverse student population and large amount of technology within the school (student to computer ratio is approximately 3:1).

Case study was also chosen because I was interested in gaining a greater insight into the specific phenomenon of how junior high students at Samuel Hearne Secondary School employ information-seeking processes when using CD-ROM encyclopedias. At the end of the research, a rich description of the phenomenon under study can be written. It includes, as suggested by Guba and Lincoln (1981), an analysis and interpretation of the "demographic and descriptive data in terms of cultural norms and mores, community values, deep-seated attitudes and notions, and the like" (p. 119). This information can only be gathered from the participants and key informants and will be limited by their responses.

This case study, using examples from the videotapes, observation, interviews, Think Aloud and Think After data, creates a picture for the reader of this specific phenomenon. The concepts and hypotheses emerge from data that is grounded in the context. As a result, this case study suggests to the readers, general and specific ideas for use in similar situations and may provide an illumination of the general problem, that is, information seeking in electronic environments.

Case study research requires that researchers take into consideration the criticisms and concerns of the method. Critics of the method cite bias of findings and conclusions as one limitation. It is essential, therefore, for me to include a complete description of the background experiences and knowledge brought to the project. My values and biases are an integral part of the research and how it was analyzed and interpreted. In presenting these central assumptions along with a discussion about how the informants and participants were selected, the research can be based on an understanding of my unique perspective. Yin suggested reporting a detailed protocol for data collection so replication in another setting can be carried out. The intent in this research is to form unique interpretations of the events within the specific context. As a result, it cannot be generalizable to other specific contexts. Rather, it was "designed for accessibility to many audiences" (Stake & Mabry, 1995, p. 295). Another concern about case studies is the massive amount of data that can be collected and time needed to complete the research process. I had a clear research plan and an organized way to deal with all of the data.

A case study, by working in natural settings, attempts to get as close to the participants and their thoughts and feelings as possible. It allows for investigating complex social relationships and multiple variables in real-life situations and it offers "insights and illuminates meanings that expand its readers' experiences" (Merriam, p. 32). Stake and Mabry stated that there is a need for "studies that dwell on the particular, and ponder the uniqueness of a situation, and that stay focused on the individual case until there is little more to be learned" (p. 303). As a result, this case study can help to advance knowledge in LIS and education.

3.4 Selection of Participants and Key Informants

For Glesne and Peshkin (1992), "the strategy of participant selection in qualitative research rests on the multiple purposes of illuminating, interpreting, and understanding – and on the researcher's own imagination and judgement" (p. 27). In this research, junior high students and members of the school community who could help inform the context were asked to participate. Of special importance were the core classroom teachers who recommended the twelve participants. Core teachers are those teachers who act as the home base and provide the core courses of the curriculum, for example, Social Studies, Health, Language Arts, and Art. The participants were selected by the teachers to represent different reading abilities, language and travel experiences, ethnic and Aboriginal backgrounds and a fairly equal gender split. A grade-seven core teacher, a grade-eight core teacher, the grade-nine mathematics/junior high computer teacher, and the Library Assistant were the key informants. To ensure that the interpretation of interviews and observations are correct, discussions have been carried out with one key informant on a regular basis.

The participants were selected by their core classroom teachers. I asked each teacher to select four students who represented a wide variety of abilities and experiences. I did set some limits as I wanted two boys and two girls. Each teacher then selected four students whom he or she thought would be willing to participate, and provided a unique perspective. I began with the grade 7 teacher and asked him to recommend four students. I used his list as a basis for the grade 8 teacher to select four more participants that might bring some different perspectives to the research. I then took the list of grade 7 and 8 students to the grade 9 teacher for her input and for the selection of the final four students. Since two of the students decided not to participate, I went back to the appropriate teachers and had them select two more students.

3.5 Ethical Considerations

Qualitative educational research, according to Cohen and Manion (1994), "requires interpersonal skills of a high order, supported by humane personal and professional values rooted in a shared culture" (p. 349). To support this research, both the University Standards for Protection of Human Research Participants established by the University of Alberta and Doing Research in the Northwest Territories: A Guide for Researchers required by the Northwest Territories was followed. Participants in the research were asked to sign informed consent letters and the junior high students in the study also needed informed permission from a parent or guardian. All participants and their parents or guardians were made fully aware that their confidentiality and anonymity would be protected to the fullest extent possible. In the short term, while memories of this research project are fresh, members of the Inuvik community who read this dissertation may be able to determine the identities of some of the participants and key informants.

To obtain informed consent in Inuvik, it was important for discussions to take place with parents and members of the school community so that the research could be carefully explained. Many other people stopped me on the street, in the grocery story, and in the public library, to ask me about my research. Inuvik is a small town and news travels fast. I felt it was a sign of trust from the community that so many people wanted to know about the research. I felt confident that I had clearly explained the project to them.

I met several people during my time in Inuvik who spoke to me about reading my letters asking for permission to do research in the community. One former teacher spoke to me about being the one to receive the letter at the Gwich'in Tribal Council office. Another person spoke to me about being on the board of an organization that approved my request. Several people had heard about the research from their nieces, nephews or grandchildren. At a community wedding, I met with several parents and family members and spoke about the research. In these informal ways, I spoke to community members about my research. This felt like a comfortable and appropriate way to explain the research in this community.

However, for Glesne and Peshkin, "ethics is not something that you can forget once you satisfy the demands of human subjects review boards and other gatekeepers of research conduct". Throughout the study, the participants were treated with respect and dignity.

Every attempt was made to avoid harm coming to any participant. When writing the profiles, I used the language of the participants to ensure that I came as close as possible to telling their story. I also sent the profiles to the participants and their parents to get their corrections and comments so that they could be happy with what I had written about them (Appendix J).

I also asked for renewed consent from the participants (Appendix K) to ensure they were willing to continue to participate. Included in the package sent out in February of 2000 was a copy of the profile and a permission letter for parents to sign (Appendix L) if they felt willing to allow their child to continue to participate in the research. Since I had been gone from the community for over three months, I wanted to make sure that participants knew that I was still interested in them. I did not want any participant to feel like he/she no longer wanted to participate but could not tell me so. This renewed consent ensured, to the fullest extent possible, that participants and their parents were aware of the personal information to be included in the profiles.

I received all of the consent and permission letters back except for one. That participant told one of the key informants that he had read the profile, really liked it and had no changes but, he had lost the package. I telephoned his parents at home and asked them if they were still willing to have their child participate in the study. They told me that they had seen the letter and the profile and that they were still in support of the research and felt comfortable with the profile.

In the letter sent out to participants and their parents in February of 2000, I promised that I would send copies of the dissertation to the public library, the school library and the Aurora Research Institute. When the dissertation is bound, I will send letters to all of the participants thanking them again for their help and reminding them where they may look at or borrow copies of the dissertation. I also plan to provide the key informant, who provided the member check throughout the research, with a copy of the dissertation for her classroom. She has said that she will also make the dissertation available to participants and other students who would like to look at or read it.

It was important to keep in mind the work of Scollon and Scollon (1981) when planning to do research in an ethnically diverse community. The authors' work suggested that interethnic communication could result in confusion, misunderstanding and conflict. In the North, this is problematic because of the increasing amount of communication with "modern western society" or "The South". In their study, Scollon and Scollon focused on interethnic communication between the English-speaking majority and Athabaskan speakers at Fort Chipewyan, Alberta. The Gwich'in people in the Mackenzie Delta speak a dialect of an Athabaskan language. Confusion and misunderstanding was often a source of frustration for both groups and as this miscommunication increases, racial and ethnic stereotyping developed and caused problems with further communication.

For Scollon and Scollon, the discourse system produced the greatest difficulty in interethnic communication.

> It is the way ideas are put together into an argument, the way some ideas are selected for special emphasis, or the way emotional information about the ideas is presented that causes miscommunication. The grammatical system gives the message while the discourse system tells how to interpret the message. The greatest cause of interethnic problems lies in the area of understanding not what someone says but why he is saying it. This information about why people are speaking is not signaled in the same way in all ethnic groups, and so some mis-understandings can result even where the grammatical systems are nearly identical. (p. 12)

Table III: Interethnic Communication Areas of Confusion

What's confusing to English speakers about Athabaskans	What's confusing to Athabaskans about English speakers
They do not speak	They talk too much
They keep silent	They always talk first
They avoid situations of talking	They talk to strangers or people they do not know
They only want to talk to close acquaintances	They think they can predict the future
They play down their own abilities	They brag about themselves
They act as if they expect things to be given to them	They do not help people even when they can
They deny planning	They always talk about what's going to happen later
They avoid direct questions	They ask too many questions
They never start a conversation	They always interrupt
They talk off topic	They only talk about what they are interested in
They never say anything about themselves	They do not give others a chance to talk
They ask questions in unusual places	They are always getting excited when they talk
They talk with a flat tone of voice	They aren't careful when they talk about things
They are often too indirect, inexplicit	They aren't careful when they talk about people
They just do not make sense	
They just leave without saying anything	

Source: Scollon, R., & Scollon, S. B. K. (1981). Narrative, literacy and face in interethnic communication. Norwood, NJ: Ablex, p. 36.

For the researchers, the difficulties with interethnic discourse in that particular study are the result of the differences between the "modern consciousness" reality set of English speakers and the "bush consciousness" of Athabaskan speakers, with its basis in oral narrative discourse. Scollon and Scollon provided a chart that summarized areas of confusion for both Athabaskan and English speakers (see Table III). This information will be considered when dealing with key informants and participants in both formal and informal situations.

Another interesting study that applies to the work in this ethnically diverse context is by Roberts, Clifton and Wiseman (1989). This study looked at the values of Inuit students (10-16 years of age) in the Northwest Territories as compared to White students from Southern Canada. These values included: activism, individual accomplishment, integration with relatives, occupational primacy, and trust. The study found "that Inuit students have less modern values than their white peers, that Inuit students display a wide range of scores on all five orientations, and that the mean scores for Inuit students vary considerably across the five value orientations" (pp. 17-18). This would seem to imply that Inuit students see themselves as unique individuals within a community that sustains its distinctive culture. Therefore, it was important to recognize that people within the Inuit culture, while seeing themselves as part of the Inuit community, are uniquely individual. I attempted to ensure that both of these values were honoured when in discussions with Inuvialuit participants and key informants.

3.6 Data Collection Procedures

To ensure a rich description and understanding of the complex phenomenon of junior high students' information-seeking processes when using CD-ROM encyclopedias, a variety of data collection procedures were used. For Glesne and Peshkin (1992), the use of triangulation, or "multiple-data-collection methods contributes to the trustworthiness of the data" (p. 24). A triangulation of data collection methods included Think Alouds and Think Afters, interviewing, observation, and videotaping. This section includes an overview of each method and specific detail about how the data was collected using the method.

3.6.1 Think Alouds and Think Afters

Think Alouds and Think Afters are used in this study to describe concurrent and retrospective verbal protocols, respectively. Cognitive psychologists use the term verbal protocol analysis to describe these methods. Verbal protocol analysis is a way to gain information about the cognitive processes of a participant's internal states using verbal reports. Ericsson and Simon (1984) described verbal reports as "bringing into attention, then, when necessary, converting it into verbalizable code, and finally vocalizing it" (pp. 15-16). After much research and investigation, I determined that two types of verbal reports would give the best information about the information-seeking processes of junior high students. Concurrent verbal reports, the first type of verbal reporting, are also referred to as talk aloud, think aloud or thought listing techniques. Retrospective verbal reports, the second method, rely on gathering information after the task is completed.

3.6.1.1 Review of the Literature on Think Alouds and Think Afters

Ransdell (1995) pointed out that protocol analysis "is one of the few methods available in cognitive psychology that gathers data with sufficient temporal density to test models of online, second-by-second behaviour" (p. 89). Protocols done properly, according to Russo, Johnson and Stephens (1989), "ask subjects to report their thoughts, not to explain them" (p. 759). Ericsson and Simon (1984) discuss the history of verbal reports and introspection in the first chapter of Protocol Analysis: Verbal Reports As Data. They suggest that the method is a very old one. Philosophers such as Aristotle and Plato used introspection to inquire about the nature of man by examining their own cognitive processes. Van Someren, Barnard & Sandberg (1994) explained that the main advancement with the method over the years was that verbal reports began to be treated as data instead of conscious processes. It was near the end of the 1960s that the method was revived again. As interest in cognitive processes grew, the interest in methods that could provide information about these processes grew as well. Newell and Simon (1972) used this methodology to build very detailed models of problem-solving processes. According to van Someren, Barnard and Sandberg (1994), "this work had a major influence, because it showed that very detailed explanations of verbal data can be obtained" (p. 31). The method continued to be accepted as designing of expert computer systems began to grow. The need to find out about a human expert's knowledge to create these computer systems made the method more popular. According to Ericsson and Simon (1984), "the real breakthrough came when the Think Aloud method could be given explicit meaning in terms of a formal model of the thought processes that could be simulated on a computer" (p. 61).

The Think Aloud method is now accepted by a large part of the scientific community and is being used in a variety of different research areas. Hayes and Flower (1983) and Ransdell (1995) have done extensive research in the area of writing. Whitney and Budd (1996) used the method to study text comprehension and other researchers have used the method to study reading comprehension strategies (Davey, 1983; Garner, 1982; Kavale & Schreiner). Cacioppo, von Hippel and Ernst (1997) cite the many uses of verbal protocol research in clinical and counseling psychology. Murtaugh (1984) used verbal protocol analysis to study the grocery shopping decision-making process. Sullivan and Seiden (1995) assessed the online catalogue user's education needs using the method.

More recently, it has been used as a method in research projects more similar to this piece of research. McGregor (1994b) used the Think Aloud method to analyze the thinking in the research process of high school students. Nahl and Tenopir (1996) used the Think Aloud method as faculty and graduate students searched a full-text online database of magazines. The researchers were interested in the search strategies and the affective, cognitive and sensorimotor behaviours of the participants. Yang (1997) used verbal protocol analysis and observation to study six cases of information-seeking behaviour in university students as they accessed information in the Perseus Hypertext System. The researcher had each participant practice the Think Aloud method before asking them to think aloud while working on the problem. Hughes, Packard and Pearson (1997) also used the Think Aloud method in looking at reading in a hypertext environment. They introduced the method to the participants using a video of other computer tasks so that the method was demonstrated without "suggesting strategies for using the intended target of research" (p. 5).

Xie and Cool (1998) used the Think Aloud method to study end-user online searching. They found through the use of this method that "much insight is gained into the problems encountered by searchers and the adaptive strategies they employ in such situations" (p. 329). Tallman and Henderson (1999) used the Think Aloud method to look at the mental models of teacher-librarians as they taught students about electronic resources. Hirsh (1999) used the think aloud method to study elementary students' relevance criteria and search strategies during a school project. Her results have implications for how we teach students about information literacy and for the design of systems.

The greatest strength of the method is the ability to use it to generate hypotheses. According to Cacioppo, von Hippel, & Ernst (1997), the method is "particularly useful when one either has no predetermined ideas about the cognitive dimensions that are relevant or has only a few untested hunches" (p. 929). Pressley and Afflerbach (1995) note that verbal protocol analysis provides a way of gathering data on cognitive processes that, otherwise, could only be studied second hand. The method also allows an insight into affective processes as well as cognitive processes. Wilson (1994) made a point of mentioning the method's versatility and this can be seen in the variety of research areas in which the method has been used. The method can be used successfully with naïve users as well as experts.

For qualitative researchers interested in getting a rich source of data, the verbal protocol methodology is a wonderful choice. Wilson (1994) emphasized that "people's conscious thoughts can be an excellent source of inspirations" (p. 251). Pressley and Afflerbach (1995) expanded the idea by noting that "spoken language is the data used in protocol analysis and the richness and variability of language are the greatest assets and liabilities of the verbal reporting methodology" (p. 2).

However, this method has a long history and has experienced much criticism. The first and most often cited criticism states that verbal data is incomplete and that behavioural and performance changes cannot be gathered by the method. For Hayes and Flower (1983), because the method is so idiosyncratic, a participant "may fail to verbalize a considerable part of the information that passes through the short term memory" (p. 61). The researchers added that this type of reporting would cause the distortion of cognitive processes even if a person were to be aware of the processes. Ericsson and Simon (1984) suggested another criticism that they call the epiphenomenality or irrelevance argument. This argument "is that the verbalizations may report an activity that occurs in parallel with, but independent of, the actual thought process, hence provides no reliable information about the latter" (p. 61).

Researchers have suggested that the production of verbal reports may change the cognitive processes being studied. Fawcett (1993) felt that in certain situations the participants will be so focused on the task that they will be either unable to think aloud or the thinking aloud will interfere with the process (p. 97). Verbal reports have also been criticized as not being generalizable because they are so idiosyncratic. Hayes and Flower (1983) suggested that verbal reports are not objective and are not scientific. Steinberg (1986) also suggested that "the presence of the person arranging for the protocol and of the tape recorder and the very nature of the protocol session distort the cognitive processes of the [subject] giving the protocol" (p. 699). These criticisms have been levelled at almost all research involving fieldwork such as observation and interviews. The Think Aloud method has been better received than the Think After method. Many of the concerns about retrospective protocols focus around the problem of forgetting and fabrication. Retrospective protocols may be influenced by a "motivational shift [that] can occur whenever subjects are informed that they will have to generate a subsequent verbal report" (Russo, Johnson, & Stephens, 1989, p. 765).

Ericsson and Simon (1984) based their work on the constructs of short-term and long-term memory from information processing theory. They require the reader and researcher to accept their hypothesis that all human cognition is information processing. Further, Ericsson and Simon noted "that a cognitive process can be seen as a sequence of internal states successively transformed by a series of information processes" (p. 11). Long-term memory contains a vast amount of knowledge, both procedural and factual, that can be accessed. The way this information is organized is highly individual. Short-term memory, on the other hand, is extremely limited if the information is not acted upon. External stimulation and associations from long-term memory are the basis of short-term memory. According to Pressley and Afflerbach (1995), "an important property of short-term memory is that people can quickly access the contents of short-term memory and report them" (p. 6). So it is this short-term memory that verbal reports tap. Ericsson and Simon (1984) used this conclusion to validate the think aloud data that was gathered earlier in the century.

3.6.1.2 The Pilot Study

A pilot study for this dissertation research was done to determine the best method to gather data about information-seeking processes of junior high students as they searched for information in Microsoft Encarta 98 (Branch, in press). The study discussed the benefits and limitations of using one or both of these methods to understand these information-seeking processes and provided an analysis of the effectiveness of the Think Aloud method and the Think After method. The amount of data generated during the Think Alouds and Think Afters depended on the difficulty of the questions and the number of "dead ends" encountered by the students during their searching. From the results of this small study, it seemed that Think Alouds produced more words during a difficult search activity.

Both Think Alouds and Think Afters provided useful data. The Think Alouds provided data about the sensorimotor, cognitive and affective processes that the students use in searching in the CD-ROM encyclopedias while the Think Afters provided data about the sensorimotor and cognitive processes but little of the affective processes. Both are very important to understanding the complex phenomenon of how junior high students interact with CD-ROM encyclopedias. Participants had mixed opinions on which method, Think Alouds or Think Afters, they preferred.

To better allow students to describe their information-seeking processes, however, it seemed that some other method of recording data was needed. Using videotapes of the search activities would be one way to increase the amount and detail of data in the Think Afters. The computer screen would be videotaped and after each search activity the videotape would be played back to enable participants to better remember their information-seeking processes. At this time, the participant and I would be able to interact with the video and discuss the cognitive, affective and sensorimotor processes involved. In order to gain a complete understanding of the complex phenomenon of information-seeking processes of junior high students using CD-ROM encyclopedias, rich data need to be generated. It is the combination of Think Alouds, Think Afters, and videotaping methods that would provide the best data for this understanding.

3.6.1.3 Collecting the Data

The Think Alouds and Think Afters were recorded using audiotapes. Two tape recorders were set up to record the voices of the researcher and the participant. One of the microphones was positioned near the researcher. To record as much talk as possible, a microphone was attached to the shirt or collar of each participant. The researcher used the audiotapes and the videotapes to create the most complete written transcript possible. The transcripts were used as the primary source of data (see Appendix M for an example of a Think Aloud transcript and Appendix N for an example of a Think After transcript).

The Think Alouds and Think Afters were transcribed verbatim from the participants. I included all of the utterances such as "umm" and "mm hm" in the transcripts. I also added to the transcripts from the videotapes. Anything written in brackets explains what the participant was doing. This included what search term was being typed in, what they were looking at or clicking on when making a statement. Pieces of the transcripts used in Chapters 5 and 6 include the additional information in brackets to help the reader have a better understanding about the search.

After permission from parents and consent from participants was received, I arranged for each participant to come for an initial interview. A few days after the initial interview, participants were brought to the research room for Search Session 1. At that time I went over the research project again, in a general way, and introduced the participants to Think Alouds, Think Afters and the CD-ROM encyclopedias (Appendix O).

In the Appendix of Ericsson and Simon's (1993) Protocol Analysis: Verbal Reports as Data they present practical advice on how to do Talk Alouds and Think Alouds with subjects. For Ericsson and Simon, "apart from the instruction to verbalize and the production of the verbalization, the only differences are the presence of the monitoring experimenters and of the tape recorder" (p. 375). They state that "in many tasks, especially problem-solving tasks, subjects get so involved in the task that little notice is taken of the environment, and situational factors have no real effect" (p. 375). The authors suggest keeping the tape recorder and experimenter out of the view of the subject. When the experimenter is seated behind the subject, the subject may not then "feel obliged to address the experimenter or turn around to answer him" (p. 376). The authors suggest that "the number of verbalizations that are social and directed to the experimenter may be used to evaluate how much the experimenter has intruded" (p. 376). Ericsson and Simon also suggest that if subjects do not appear to "verbalize as much as normal subjects, one can give them more practice problems" (p. 377).

Although the work of Ericsson and Simon is recognized as seminal in the field of verbal protocol analysis, I chose to follow a modified approach in this research study. I did not feel comfortable sitting behind the participants while they searched. I was not concerned with "intruding" into the search as the researcher. As a matter of fact, I felt that I was very important to the research. The terms used by Ericsson and Simon, for example, subject, experimenter, variables, traditional experiment, reliability, validity, generalizability, and hypotheses, are not terms used in qualitative research. I was interested in spending time with junior high students while they searched. I wanted to be open to what would happen in the research setting.

Ericsson and Simon's verbal protocol analysis is firmly set within the positivist paradigm as they are concerned with reliability, validity and generalizability. In the naturalistic paradigm, "realities are multiple, constructed, and holistic" (Lincoln & Guba, 1985, p. 37). The researcher and the object of the research, in this case the participants, interact to influence one another and the inquiry is value-bound. For Lincoln and Guba, "the aim of the inquiry is to develop an idiographic body of knowledge in the form of "working hypotheses" that describe the individual case" (p. 38). My inquiry was influenced by my values as expressed in my choice of this particular case and problem and how it was framed, bounded, and focused.

3.6.2 Observation

A researcher using the case study framework usually spends much of the field work time observing the specific case. For Cohen and Manion (1994), "the purpose of such observation is to probe deeply and to analyze intensively the multifarious phenomena that constitute the life cycle of the unit" (pp. 106-107). Observation allows researchers to pay close attention to any non-verbal behaviour and unusual aspects and provides first hand experience. Information can be recorded as it occurs over an extended period of time and since researchers tend to spend a long period of time in the natural setting they can develop close and informal relationships with participants.

We, in our day-to-day life, observe situations, friends and strangers as they interact with one another and with us. According to Glesne and Peshkin (1992), "participant observation in a research setting, however, differs in that the researcher carefully, systematically experiences and consciously records in detail the many aspects of a situation" (pp. 42-43).

3.6.2.1 Review of the Literature on Observation

Observation has been used in many of the studies that look at information seeking (Kuhlthau 1983, 1991; McGregor 1993; Pitts 1994). Perzylo and Oliver (1992) used an ethnographic observation approach to study how children retrieved information from the National Geographic Mammal Multimedia Encyclopedia. The researchers acted as non-participant observers, kept field notes, and videotaped the interactions of pairs of students. Pappas and Geitgey (1994) observed three sets of students in a high school library using The Grolier Multimedia Encyclopedia. In this very small study, they wanted to find out how students gathered information using an electronic encyclopedia and what roles teachers and teacher-librarians played in the search process.

Marchionini (1989) used observation to study the information-seeking strategies of elementary school students searching a full-text electronic encyclopedia. In this study, "the observer gave a brief review of system commands before students began their searches but answered no questions and made no comments once the searches began" (p. 57). Large and his colleagues (Large et al., 1998; Large et al., 1994a, 1994b, 1995, 1996; Large et al., 1999) used observation in all of their studies including the one that looked at grade six students as they interacted with the print and CD-ROM versions of Compton's Encyclopedia (Large et al., 1994a). They used observations to note the retrieval times and the search strategies in the print encyclopedia but captured keystrokes to look at search strategies in the CD-ROM version. Yang (1997), in her study of information seeking using the Perseus Hypertext System, used observation to document operations, body language, comments and actions using note-taking. Audio and video taping methods were also employed.

According to Adler and Adler (1998), "not only is observation one of the earliest and most basic forms of research, but it is most likely to be used in conjunction with others, such as participant observation, experimental design, and interviewing" (p. 80).

However, there are limitations to the method. Cohen and Manion (1994) stated "the accounts that typically emerge from participant observations are often described as subjective, biased, impressionistic, [and] idiosyncratic" (p. 110). In any qualitative study, these limitation are acknowledged. Adler and Adler noted, however, that these concerns "lose salience as issues in the postmodern framework" (p. 89). Observers are able to use the creativity of the method to change questions as they learn more about the problem and the participants. Observation can be very rigorous when is it used in combination with other methods such as, in this study, interviewing, Think Aloud method, Think After method, audio and video taping. For Adler and Adler, "direct observation, when added onto other research yielding depth and/or breadth, enhances consistency and validity" (p. 90).

3.6.2.2 Collecting the Data

Glesne and Peshkin (1992) explained that "participant observation ranges across a continuum from mostly observation to mostly participation" (p. 40). Throughout the data collection, I found myself at different points on the continuum at different times with different participants. Some participants did not engage me in their search as much as others. With some participants, I was very involved in the search with them, with others, I was less involved.

Observation was quite informal in this study. I had expected to be able to make notes while each participant was searching. What I came to discover, however, was that I was engaged with each participant in the search and was unable to write notes while I was a participant observer. It seemed more important for me to give my full attention to the search and the participant.

3.6.3 Interviews

Glesne & Peshkin (1992) have suggested that interviewing was a bit like a game of baseball. An interviewer pitches the questions in hopes that the "respondents 'hit' and hit well in every corner of your data park, if not clear out of it – a swatted home run of words" (p. 63). The common thing in any interview, according to Cohen and Manion (1994), is that a transaction occurs involving the person who wants the information and the person who supplies the information. The interviews in this research were both structured and unstructured depending on the informants, the participants and the developing nature of the interactions with CD-ROM encyclopedias. Glesne and Peshkin stated that the "opportunity to learn about what you cannot see and to explore alternative explanations of what you do see is the special strength of interviewing in qualitative inquiry" (p. 65).

3.6.3.1 Review of the Literature on Interviews

Interviewing has been used in many pieces of research in the area of information seeking. Kuhlthau (1996) used in-depth interviews within a case study framework to look at two participants and the role of intermediaries in the information search process. Kuhlthau (1988) used "observations and interviews as well as a number of other devices - namely, journals, search logs, time lines and flowcharts - to reveal the search process" (p. 234). Pitts (1995), in a summary of her dissertation research, described the interviewing of students as one of the primary data sources. However, she also interviewed teachers, teacher-librarians, principals and adults outside the school. Unstructured interviews occurred as part of the observations of the students and structured interviews were conducted based on "data obtained during observation" (p. 179). McGregor (1994a) used interviewing to "capture immediate reactions and perceptions of the process" (p. 71). Marchionini (1989) used interviews throughout his study of mental models of print and CD-ROM encyclopedias. Students were asked to describe experiences with libraries and computers, explain their "knowledge of sources, and how [they] linked terms to the task (topic), terms to sources, and task to source" (p. 597)

According to Glesne and Peshkin (1992), "interviewing puts you on the trail of understandings that you may infer from what you observe, but not as the actors themselves construe their actions" (p.65). Without interviews, you cannot get the actor's explanations or their ideas about future behaviour. It is important to note, according to Glesne and Peshkin, that "discrete questions do not amount to a theory; they do, however, point toward an understanding of the complex phenomenon" under study (p. 66). It was important that some of the limitations of interviewing be discussed as well. Interviews may include indirect information filtered through the view of the participants. It was important that the questions be culturally relevant and be drawn from the experiences of the participants. I generated questions that were based on the knowledge of key informants and on a reading of all relevant literature. Because I was a part of the community and was interviewing in the natural setting, I believe that participants were honest.

3.6.3.2 Collecting the Data

Questions for the interviews were developed for key informants and for participants. The key informants were asked the following questions:

1. How much time do you spend per week on the computer?
2. What is your own CD-ROM encyclopedia expertise?
3. What things do you think influence your own searching on CD-ROM encyclopedias, the Internet, print encyclopedias, OPACs and card catalogues?
4. What factors do you think influence junior high students information-seeking processes?

The participants were asked the following questions:

1. Tell me about your family.
2. Where were you born?
3. Where have you lived?
4. How long have you lived in Inuvik?
5. What things do you do in your free time?
6. Do you like to read? What kind of books do you like to read? How much time do you spend reading each week?
7. Do you play video games? What kinds of video games do you rent? How much time do you spend playing video games each week?
8. Do you rent movies? What kinds of movies do you rent? What are your favorites? How much time do you spend watching videos each week?
9. What are your favorite bands? How much time do you spend listening to music each week?
10. What are your favorite television shows? How much time do you spend watching television each week?
11. Do you have a computer at home? What do you use it for? How much time do you spend on the computer each week?
12. What other things do you like to do?
13. Where have you traveled?
14. How do you find out about things you are interesting in?
15. What things do you think influence how you search for information?

The interviews were recorded using audiotapes. These tapes were transcribed and key informants had the opportunity to review the written transcript and add, delete or comment on any aspect of the discussion. None of them made any changes to the transcripts. Participants were sent the profiles generated from the initial interview and asked to make corrections and comments. More than half of the participants made small changes. Most of these changes had to do with favorite bands, television shows, video games, movies and reading materials. The changes are incorporated into the profiles in Chapter 4.

All interviews took place in the research setting. Two tape recorders were set up on the desk and the participant and I sat facing each other. I kept the list of questions on the desk to refer to as the interviews progressed. With the key informants, the discussion was quite structured. With the participants, on the other hand, the interview was much more informal. I had a list of questions but often the student answered several questions in the same answer. I encouraged the participants to share anything they felt was important for me to know about them.

3.6.4 Capturing Search Data

Researchers interested in information seeking have used many different methods to capture the data from the searches. As a result of the research done in the pilot study (Branch, in press), I decided to videotape each search. I had been involved in a research project that used the videotaping method and I felt that it was very effective. I wanted a simple way to replay the search for participants so that we could discuss their information-seeking processes.

3.6.4.1 Review of the Literature on Capturing Search Data

Anderson-Inman et al. (1994) used "an electronic monitoring program that invisibly recorded the time and sequence of all choices made by students as they read the stories and accessed available resources" (p. 283). In research by Marchionini and Liebscher (1991), "an electronic log of all keystrokes made by participants together with the time between key strokes was recorded automatically" (p. 42). This was done without the participant's knowledge. Bilal (2000) used Lotus Screen Cam to capture the activities in the web browser searches (p. 648). Large et al. (1994a) had observing research assistants make detailed logs of searches and record search time. In a study of interface navigation, Large et al. (1998) used a converter to "capture screen images directly from the workstation's system unit on to VHS tape" (p. 292). Nahl and Tenopir (1996) downloaded the searches on the full-text database for later analysis. Researchers interested in information seeking have used many different ways of recording searches. For me, videotaping was the best choice because I was doing the research alone. I also did not have a powerful enough computer to use the appropriate software to do screen captures.

3.6.4.2 Collecting the Data

The video camera was positioned behind the participant's left shoulder and only videotaped the screen during searches. The video camera was attached to a large television so that the participant and I could watch a replay of the search during the Think Afters. Each student's search sessions were recorded on videotape. The videotapes were used to add detail to the transcripts.

3.6.5 The Research Setting

The research setting was a small classroom that was being used as a science storage room. It was filled with videos, books, and other science materials. It was located at a quiet end of the school where there would be few disruptions. A computer workstation on a movable cart, a television, and a tripod with the video camera were added to the room. The participants were seated at the computer workstation during the searches. The computer was had a Pentium processor, with a 12x CD-ROM drive and a colour monitor with low resolution. Speakers were attached to the computer and sat on either side of the computer. To view the videotapes, we turned our chairs around to face the television. The interviews began on September 28th and the last search session took place on November 4th (See Appendix P).

3.6.5 Introduction to the CD-ROM Encyclopedias

Each participant was given a very general introduction to the CD-ROM encyclopedias (See Appendix O). The participants explored the search features and the navigation features of each encyclopedia. Any symbols that might be confusing were explained. I did not provide any information about searching in the introduction. Microsoft Encarta Encyclopedia Deluxe 2000 was chosen because it is a very popular encyclopedia and is often part of bundled software in a new computer purchase. Earlier versions of this encyclopedia were located in the school and public library as well as some of the classrooms. I selected 1999 World Book (Deluxe) because it has more Canadian content and because the school and public library have multiple sets of the World Book print encyclopedia. In my experience, it is the print encyclopedia of choice for most junior high students. It is written for a younger audience and, therefore, the vocabulary is easier for most of our students.

Microsoft Encarta Encyclopedia Deluxe 2000 and 1999 World Book (Deluxe) both use full-text searching to retrieve topics. Microsoft Encarta Encyclopedia Deluxe 2000 searches for articles where all the words appear. For example, when a participant typed in *first woman in space* Microsoft Encarta Encyclopedia Deluxe 2000 retrieved all articles with the words *first*, *woman*, and *space* in them. 1999 World Book (Deluxe) is different in that it searches for those same words to appear in one sentence in an article. As a result, 1999 World Book (Deluxe) retrieved fewer articles than Microsoft Encarta Encyclopedia Deluxe 2000. Using the search by word in 1999 World Book (Deluxe) and changing the full-text searching from sentence to paragraph or article, retrieved more articles.

3.6.6 Search Session 1

Search Session 1 took place between October 6th and October 14th ,1999. Participants were introduced to the CD-ROM encyclopedias during the session. All twelve participants answered the same four search questions:

1. Who was the first woman in space?
2. Describe the cardinal, a bird.
3. Who was the first man in space?
4. Describe the boxer, a dog.

The questions were asked in the same order to each participant. Two of the participants used 1999 World Book (Deluxe) for the first two questions, but the majority used Microsoft Encarta Encyclopedia Deluxe 2000. Each participant was given the choice of which CD-ROM encyclopedia to begin with. Most were more familiar with Microsoft Encarta Encyclopedia Deluxe 2000 and chose it. Questions 1 and 3 were determined to be complex searches with four terms in the query, for example, first woman in space. Questions 2 and 4 were determined to be simple searches with one term in the query, for example, boxer.

3.6.7 Search Session 2

Search Session 2 took place between October 14th and October 28th,1999. Participants began searching immediately and did not have a refresher course in the CD-ROM encyclopedias. The grade seven participants answered the following questions:

1. How long is the Alaska pipeline?
2. Who designed the flag of Alaska?
3. What was the population of the capital city of Alaska in 1996?
4. In what year did Alaska have a huge earthquake?

Participants searched for the answers to questions 1 and 2 on 1999 World Book (Deluxe) and questions 3 and 4 on Microsoft Encarta Encyclopedia Deluxe 2000. Questions 2 and 3 were determined to be the most complex with more than three search terms. Questions 1 and 4 were determined to be the simple searches with less than three search terms. All the grade seven participant completed Search Session 2 on October 21st.

The grade eight participants answered the following questions:

1. What is the official language of Egypt?
2. During what years did Ramses II reign?
3. What is the origin of the word pharaoh?
4. Find the flag and the national anthem of Egypt.

Participants searched for the answers to questions 1 and 2 on Microsoft Encarta Encyclopedia Deluxe 2000 and questions 3 and 4 on 1999 World Book (Deluxe). Questions 2 and 3 were determined to be the simple searches with less than three search terms. Questions 1 and 4 were determined to be the complex searches with more than three search terms. The grade eight participants completed Search Session 2 on October 14th and 15th.

The grade nine participants answered the following questions:

1. What is the lift of the Welland Canal?
2. Name a country through which the equator passes.
3. Into what body of water does the Nelson River flow?
4. Name a country through which the Tropic of Cancer passes.

Participants searched for the answers to questions 1 and 2 on Microsoft Encarta Encyclopedia Deluxe 2000 and questions 3 and 4 on 1999 World Book (Deluxe). Questions 2 and 4 were determined to be the most complex with more than three search terms. Questions 1 and 3 were determined to be the simple searches with less than three search terms. The grade nine participants completed Search Session 2 on October 28th.

3.6.8 Search Session 3

Search Session 3 took place between October 29th and November 4th,1999. Participants were given a form at the end of search session two so they could write down their questions for Search Session 3 (See Appendix Q). Several of the participants forgot or lost their question sheets so I gave them time at the beginning of the session to write down four questions. Not all participants had four questions. The participants were able to choose which encyclopedia they would like to use to search for each question.

3.7 Data Analysis Procedures

Data analysis is the process of organizing all the gathered information to make sense of what has been learned. This is the time when the researcher begins sifting through the data to

> Create explanations, pose hypotheses, develop theories, and link [her] story to other stories. To do so, [she] must categorize, synthesize, search for patterns, and interpret the data [she has] collected (Glesne & Peshkin, 1992, p. 127).

Data analysis is an ongoing process that begins even before data collection. It means, according to Glesne and Peshkin (1992), the researcher must "consistently reflect on [her] data, work to organize them, and try to discover what they have to tell [her]" (p. 127). As the research progressed, transcripts, videotapes and observation notes were used to generate ideas, thoughts and new questions throughout the data collection. According to Patton (1990), although it is tempting to go right to interpretation of the data, description must come first. "The discipline and rigor of qualitative analysis depends on presenting solid descriptive data, what is often called "thick description", in such a way that others reading the results can understand and draw their own interpretations" (p. 375). Chapter 5 contains this thick description of the information-seeking processes of junior high students in Inuvik.

For Huberman and Miles (1998), data analysis involves "three linked subprocesses: data reduction, data display and conclusion drawing/verification" (p.180). Miles and Huberman (1994) believe that these processes are intricately linked throughout the research not just after data collection. "Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions" (p. 10). The researcher begins data reduction when the research question is decided, a framework is chosen, and the research design is determined (p. 10). Data reduction continues throughout the data collection and the data analysis until the dissertation is completed. This involves "writing summaries, coding, teasing out themes, making clusters, making partitions, [and] writing memos" (p.10). The decisions made by the researcher when reducing data are all part of analysis. For Miles and Huberman, "data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that 'final' conclusions can be drawn and verified" (p. 11).

The data reduction process involves sorting information into categories so that the information begins to be formatted into a story or picture of the complex phenomenon under study. This organization and categorization of the data is a learning process and my judgements became increasingly sophisticated as I worked with the data. Developing codes and categories from the data involves getting a sense of the whole by reading all transcripts and notes after the data collection was complete. Beginning with one piece of transcript, I worked through the data making a list of topics and clustering similar topics. I returned to the data many times to try out preliminary organizing schemes or data displays to see if new codes and categories emerge.

One coding scheme that was applied to the Think Aloud data was that of Biemiller and Meichenbaum (1992). I became aware of the work of Biemiller and Meichenbaum at a job talk in the Department of Elementary Education. A candidate was discussing the researchers' work and as I listened, I knew that it might explain what had happened with some of the participants as they were doing their Think Alouds. With the names Biemiller and Meichenbaum in hand, I searched for and located several articles and their monograph. In one article (Biemiller & Meichenbaum, 1992), I found the coding scheme the researchers used when coding their own data.

The work of Biemiller and Meichenbaum (Biemiller & Meichenbaum 1992; Meichenbaum & Biemiller, 1992, 1998) looks at the self-directed learner. At first it seemed totally incongruous with this work on information-seeking processes and verbal protocol analysis. Yet, on closer study, the researchers are interested in the very same thing – the nature of thinking out loud as one does a task. Their research, conducted over the past 15 years, involves studying the most and least self-directed students in elementary schools as identified by their teachers and peers. In a study involving 70 high and 70 low self-directed learners, the researchers recorded what the students did and what the students said. This involved recording the students' self-talk, their talk to peers, and their talk to teachers. As a result of this work, Biemiller and Meichenbaum (1992) developed a coding system to analyze the "children's discourse about tasks" (p. 76).

This coding system enabled the researchers to compare high and low self-directed learners and to "infer the nature of their cognitive and metacognitive self-regulatory activities" (p. 76). This task-related speech, or Think Alouds, provided the researcher with a way of accessing the cognitive processes of a learner. Biemiller and Meichenbaum (1992) determined that "children whose level of cognitive development exceeds the complexity of tasks they are being taught have 'surplus mental capacity' permitting them to 'think' (self-dialogue) about what they are doing" (p. 76). On the other hand, children who are less cognitively advanced approached a task with fewer skills. As a result, they encountered an overload or, at the very least, needed their full attention to complete the task. These low self-directed learners had "little or no capacity left for verbal thought processes while conducting the task" (p. 76). The following is an explanation of the coding categories:

> Defining: Statement or question labels and notes features of tasks, procedures, and objects ("It's John's game." "That's red paint.").
>
> Planning: Statement or question about what will or should happen next ("Can I do X?" "Mix some soap in the paint." " Where are the sparkles?" "I need…").
>
> Conditional Planning: Statement or question related a plan to a condition or specifies the basis for choosing between alternative plans ("If we make noise, then we won't have recess.").
>
> Monitoring (ongoing task): Statement or question notes progress, or lack thereof, on the task (You're going too fast." "Slow down.").
>
> Evaluating (completed or aborted task): Statement or question concerns conclusions on ending the task – regarding the product, the child's ability, or the experience of doing the task ("This is my best one so far!" "I can't do it!" "The math squares are fun!"). (p. 78)

I applied this coding scheme to the data and the findings are described in Chapter 6 and in Branch (2000). I also looked at the data using the work of Tenopir et al. (1991) and Kuhlthau (1991).

Data display, for Huberman and Miles (1998), is "an organized, compressed assembly of information that permits conclusion drawing and/or action taking" (p.180). Displays help us to gain an understanding of what is happening. In many qualitative studies, the display of data is extended text. However, text is bulky and researchers may have difficulty coming to complete and supported conclusions using this type of data display. Miles and Huberman suggested that "humans are not very powerful as processors of large amounts of information; our cognitive tendency is to reduce complex information into selective and simplified gestalts or easily understood configurations" (p. 11). The researcher may create matrices, diagrams, flow charts, webs, summaries, graphs, networks and synopses as a basis for looking for meaning. For Miles and Huberman, all of these data displays are immediately accessible and compact. They are designed "so that the analyst can see what is happening and either draw justified conclusions or move on to the next step of analysis the display suggests may be useful" (p. 11). Data displays like data reduction are a part of analysis. For me, summaries, graphs, and webs were the most useful.

Conclusion drawing and verification also begins in data collection. The qualitative analyst, according to Miles and Huberman, "is beginning to decide what things mean – is noting regularities, patterns, explanations, possible configurations, causal flows, and propositions" (p. 11). These conclusions became increasing explicit as the data collection and analysis continued. Conclusions were verified throughout the analysis process. Miles and Huberman present the following thirteen tactics that are useful for generating meaning. Most useful in this research study were: noting patterns and themes, counting, making contrasts and comparisons, and, building a logical chain of evidence.

Miles and Huberman also present thirteen tactics "aimed at ensuring the basic quality of the data, then moving to those that check findings by examining exceptions to early patterns, and conclude with tactics that take a sceptical, demanding approach to emerging explanations" (p. 263). For this study, the following tactics were most useful:

- Checking for researcher effects
- Triangulating
- Replicating a finding
- Checking out rival explanations
- Getting feedback from informants. (p. 263)

Miles and Huberman presented these 26 tactics to help researchers draw and verify conclusions. Many of these tactics were used in this research study. Of great importance was the feedback gained from one of the key informants throughout the data collection and analysis.

Using data reduction, data display and by following some of the 26 tactics suggested by Miles and Huberman to draw and verify conclusions, an analysis of the complex phenomenon under study was carried out. This case study provides a thick description and analysis of the information-seeking processes of junior high students using CD-ROM encyclopedias. For Stake and Mabry (1995), "deep understanding is the link between case study and practice" (p. 302). This case study method does not attempt to direct practice but rather it attempts to empower teachers and teacher-librarians to "develop approaches responsive to their unique situations" (p. 303).

3.8 Chapter Summary

This chapter presented the research methodology for this study. The section on the role of the researcher discussed how I placed myself within the research context. Next, there was a brief overview of case study and why this research is such an interesting case. Sections on ethical considerations and the selection of the participants and key informants followed. Next came a description of the methods used in this research, that is Think Alouds and Think Afters, observation, interviews, and videotaping. Each was described, including an introduction to the method, a review of the literature, and how the data was collected using the method. Sections on the research setting, introduction to CD-ROM encyclopedias, and Search Sessions 1, 2 and 3 present necessary background information for the reader. The final section detailed the data analysis procedures.

CHAPTER 4

RESEARCH CONTEXT

4.1 Introduction

> *It was still dark outside. The sun wouldn't be up for more than an hour. But school had started and I decided to ask a participant to come to the study room and talk to me. I wanted to get a sense of who they are, what they do, and what it's like to be a junior high student in a remote community more than three hundred kilometres north of the Arctic Circle.*

This chapter begins with a description of the town of Inuvik. Next it describes Sir Alexander Mackenzie School, the elementary school in Inuvik, and Samuel Hearne Secondary School, where the research took place. The chapter continues with a brief overview of the senior and junior high programs. The study location is also described. A brief description of how the profiles were created and an explanation of some local terminology is next. The chapter concludes with the twelve profiles of the participants and a brief introduction to the four key informants.

4.2 Inuvik

Inuvik is located in the northwest corner of the Northwest Territories (See Figure 1). Inuvik is a planned town created by the government of Canada in the 1950s as the result of a need for an administrative centre in the Western Arctic. Aklavik, the traditional centre, was determined to be inappropriate because it was subject to flooding, erosion, and space was limited. The area that was to become Inuvik was surveyed in 1954 had a good supply of water, gravel and space to grow. Inuvik, which means "Living Place" in Inuvialuktun, the language of the Inuvialuit, officially began in 1958 by a proclamation of the 15th session of the Council of the N.W.T. Inuvik obtained village status on April 1, 1967 and town status in 1970. The town's most famous landmark is the Igloo Church (See Figure 2).

Inuvik was the first planned town north of the Arctic Circle. Inuvik was created to be a base for administration, education, medical care and development for the people of the Western Arctic. Today Inuvik has a regional hospital, an elementary school (See Figure 9), a secondary school (See Figure 10), a variety of government departments, and the headquarters for several oil and gas companies. The Dempster Highway connects Inuvik to the rest of Canada (See Figures 15 & 16). It was completed in 1979 and links the Northwest Territories to the Yukon Territories.

Figure 1: View of Inuvik

Figure 2: The Igloo Church

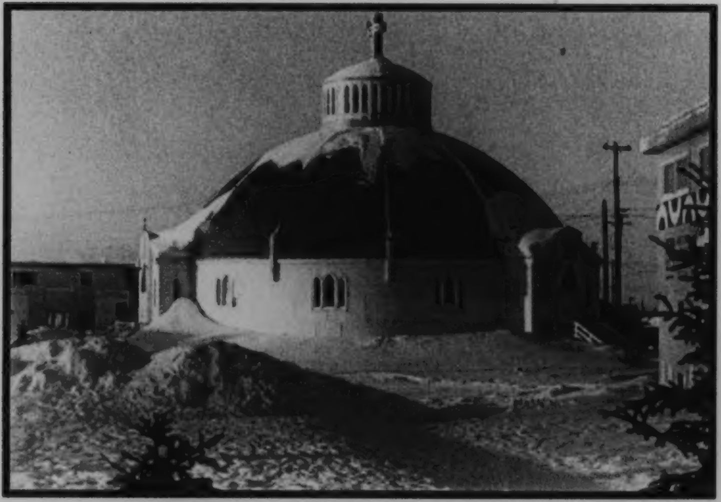
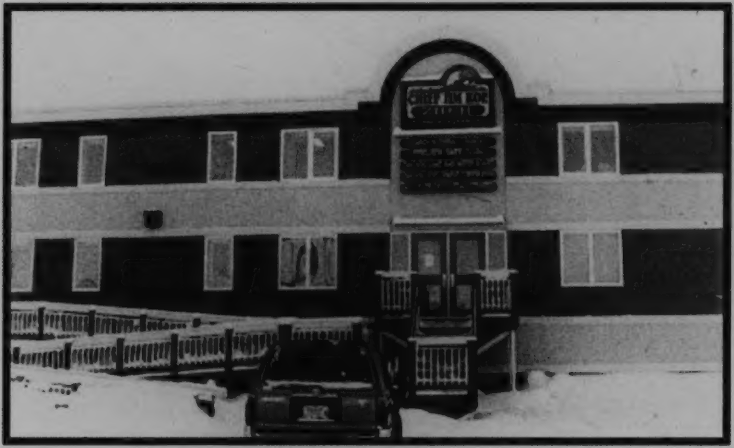


Figure 3: View of Downtown Inuvik

The town of Inuvik has a diverse population. People from all across Canada and from many countries around the world call Inuvik their home. According to the 1991 census approximately 44% of the population are Non-Aboriginal, 35% are Inuit (Inuvialuit) and 21% are Dene/Metis. The Inuvialuit and the Gwich'in have land claim agreements over the areas in and around Inuvik. Their head offices are located in the town of Inuvik (See Figures 4 & 5).

Figure 4: Invuialuit Corporate Centre

Figure 5: The Chief Jim Koe Zheh (Gwich'in Offices)



4.3 Inuvik Centennial Library

Inuvik's first library service began in the late 1950s in a room within Sir Alexander Mackenzie School. That changed when the Inuvik Centennial Library officially opened on January 15th, 1967. As the town grew, so did the library collection. By the early 1990s, space was tight. The Library Board, after lobbying for years, was finally able to acquire a new space, the old liquor warehouse, and proposals for renovations were called in 1995. The old building was transformed and the collection, now numbering over 30,000 items, was moved down the street. The new Inuvik Centennial Library was opened on June 20th, 1996 (See Figures 6,7 & 8). The Dick Hill Northern Collection was accepted as a major donation to the new library from a long-time citizen (See Figure 7).

Figure 6: Inuvik Centennial Library

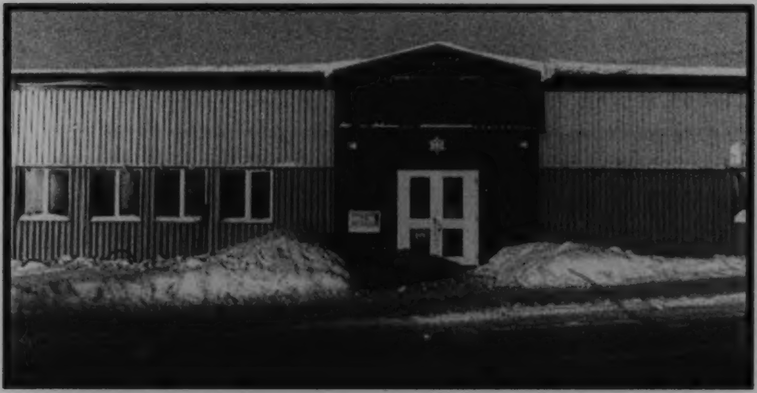


Figure 7: Videos in front of Dick Hill Collection

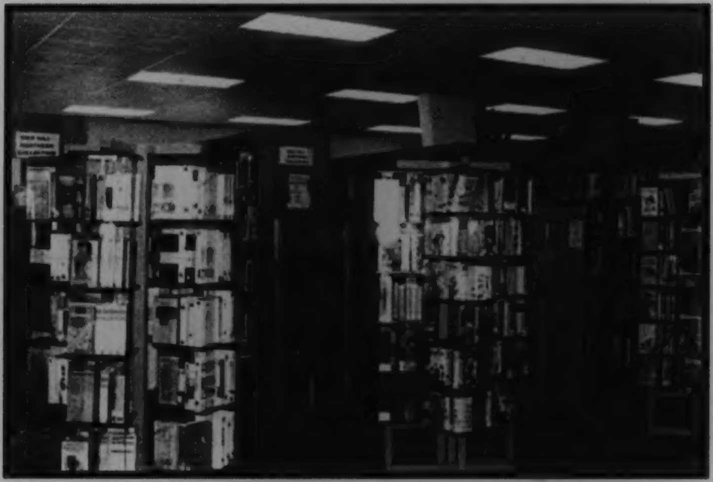
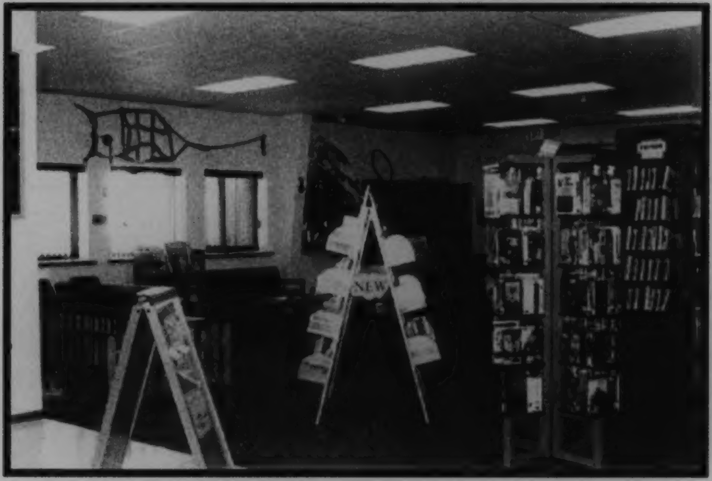


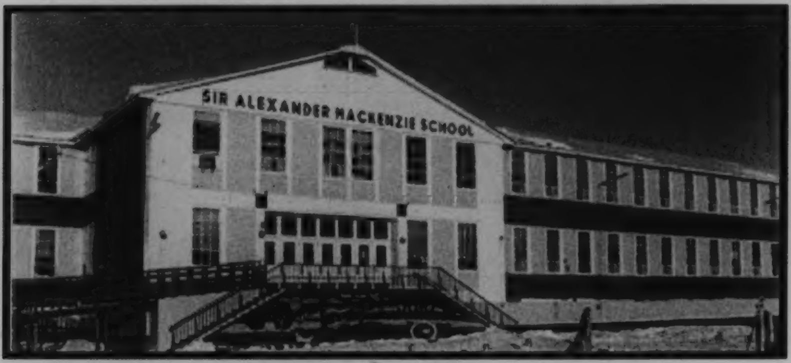
Figure 8: Reading Corner in Inuvik Centennial Library



4.4 Sir Alexander Mackenzie School

The first school to be built in Inuvik was Sir Alexander Mackenzie School (See Figure 9). It opened in the fall of 1959 and until 1969 served all grades from one to twelve in the Inuvik region. There was a Catholic Residence called Grollier Hall and an Anglican Residence called Stringer Hall and the school was divided into Catholic and Protestant sections. Up to 300 students would come to live in the residences each year. Students came from regional hamlets of Aklavik, Tuktoyaktuk, Fort McPherson, Paulatuk, Tsigehtchic and Sachs Harbour. But they also came from areas farther east, Holman, Cambridge Bay and Coppermine, and farther south, Fort Good Hope, Norman Wells, Tulita and Deline. Many of these communities are more than 800 kilometres away from Inuvik.

Figure 9: Sir Alexander Mackenzie School



In 1959, with the opening of Samuel Hearne Secondary School (SHSS), Sir Alexander Mackenzie School (SAMS) became an elementary school for students from grade one to grade six. By the 1970s, the other communities in the region started to build their own community schools for their kindergarten to grade nine students. As a result, by the end of the 1970s, the majority of students at SAMS came only from the town of Inuvik.

4.5 Samuel Hearne Secondary School

Samuel Hearne Secondary School was built in 1969 in response to a rising population in the Inuvik Region (See Figure 10). While SAMS became a school for Inuvik students only, SHSS continued to welcome students from all over the region for junior high and high school. When I began teaching in 1991, there were more than 130 students living in the residence. The residential system continued to exist for high school students – grades ten through twelve – until 1995. At that time the last residence was closed, and now students remain in their home communities for all of their schooling.

SHSS opened in the spring of 1969. It has 25 classrooms, one gymnasium, a large home economics room, a library, an automotive shop, a metals industrial technology shop, a woods industrial technology shop, an art shop, two computer labs, a biology lab and a chemistry lab. It is located in the center of town across the street from the Inuvik Centennial library, the Inuvik Fire Hall and the Inuvik Town Office. In the 1999-2000 school year, approximately 300 students were enrolled in junior high and high school. Because of the small student population, several teachers are responsible for both junior high and senior high classes. These teachers include the industrial technology specialist, the science teacher, the physical education teacher, the computer teacher, and the language teachers. The rest of the teachers work only in the senior or the junior high. For a light-hearted description of a day in the life of an Inuvik teacher-librarian, see Branch (1999).

Figure 10: Samuel Hearne Secondary School

SAMUEL HEARNE
SECONDARY SCHOOL

Figure 11: Centennial Statue in front of SHSS

Figure 12: SHSS Library

Figure 13: Fire Hall & Town Office

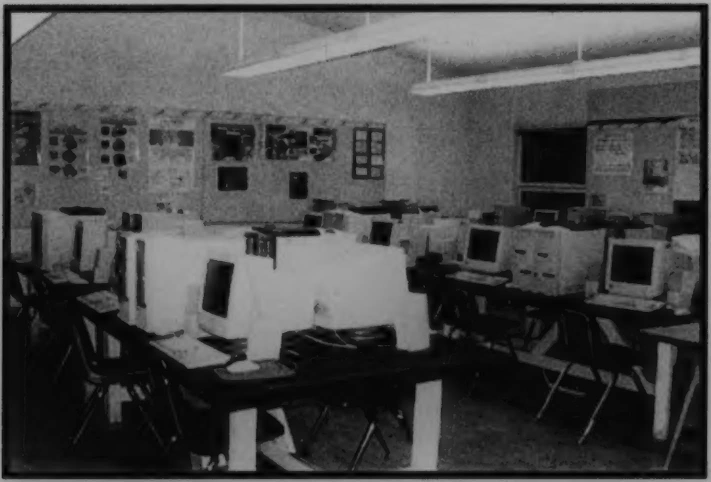
4.6 The Senior High

SHSS offers a full range of academic programs, general and advanced levels, leading to a Northwest Territories Graduation Certificate. The school also offers two basic level programs for students to receive a High School Leaving Certificate. There are approximately 150 high school students.

4.7 The Junior High

The junior high school has two grade seven classes, two grade eight classes and two grade nine classes. Students are grouped into classes heterogeneously except for Language Arts and Math, where they are grouped by ability. Their schedule is based on a half-time core and half-time rotary program. One teacher is responsible for teaching Language Arts, Social Studies, Health and Art to both classes. The rest of the subjects are taught on a rotary basis. These subjects include Physical Education, Mathematics, Science, Languages (students can choose from French, Inuvialuktun, or Gwich'in), Career and Program Planning, Computers, and Industrial Technology (See Figure 14). For each of these subjects, students have a different teacher.

Figure 14: Junior High Computer Lab



The core program in junior high began in 1993 in response to concerns from teachers, parents and administrators. Before 1993, students could have more than 14 different teachers during one school year. This was very different from their experiences at the elementary school where they had one teacher all day long except for Physical Education and Languages. Students moving from the elementary school to the secondary school were finding the movement between classes and the lack of a "home base" very difficult.

The junior high core classes are located on half of the second floor of SHSS in the junior high wing of the school. Language classes, computer classes, and mathematics classes also take place in the wing. The junior high students have lockers outside of their homeroom classes. There are six junior high homeroom classes where students report first thing in the morning and after lunch everyday.

4.8 The Study Location

A converted classroom/storage room was kindly provided for the duration of the study. It was located on the first floor in the science wing and was filled with science materials on freestanding shelving. The room also contained a desk, an office chair, Internet access, a telephone and a large blackboard. A computer, called LABRAT, was loaned to me from the senior high computer lab. It was a Pentium computer with a colour monitor, CD-ROM drive, and was linked to the rest of the school network. The room was set up with the computer next to the desk and the video camera was placed behind and to the left of the computer station. The large window's blinds were kept closed at all times to reduce the glare on the computer monitor.

4.9 The Interviews

The participants were selected by the three core teachers to represent a range of academic abilities, heritages, and life experiences. Each participant was invited to come for an initial interview to see the room, computer, CD-ROM encyclopedias, and to talk about their family background, free time, and information-seeking habits. Once permission and consent forms were returned, an appropriate time was arranged with the participant and the appropriate subject teacher.

Participants were brought to the room and shown the placement of the computer and the video camera. The video camera was not used for the initial interview. Instead, the participant and I sat near the desk with the tape recorders placed on the desk. The lengths of the profiles, which follow, indicate the depth of answers and comfort level with the researcher and the process. The interviews varied in the amount of time needed to complete the questions. The shortest interview took about ten minutes and the longest took more than half an hour. The profiles are written, as much as possible, using the language of the participants. Some of the terms may be new to the reader.

4.10 "On the Land" and "Down the Road"

In the North, people use the term 'on the land' to describe any trip out of town to a cabin, a snowmobile trip, or a boat trip. A person gets away from town to hunt, fish, trap or just enjoy the landscape. Many people hunt for moose and caribou. During the spring season, people trap muskrats. The Mackenzie Delta is famous for its muskrats and for many years it was the main source of income for Aboriginal people in the region. During the summer some Inuvialuit people go whaling in the Beaufort Sea. Many people set fish nets and dry the fish caught and the term 'dry fish' comes from that tradition.

The term 'down the road' is used to describe any trip taken on the Dempster Highway (See Figures 15 & 16). It could be a day trip to Fort McPherson, a camping trip to one of the Territorial Campgrounds on the highway, or a trip to Dawson City, Whitehorse or Edmonton. When participants talk about not getting any 'flats', they are referring to making a safe trip. The Dempster Highway is a gravel road for 763 kilometres and can be very hard on tires. I had two flat tires in a two hundred kilometre stretch of road between Fort McPherson and Inuvik.

Figure 15: Dempster Highway Sign #1

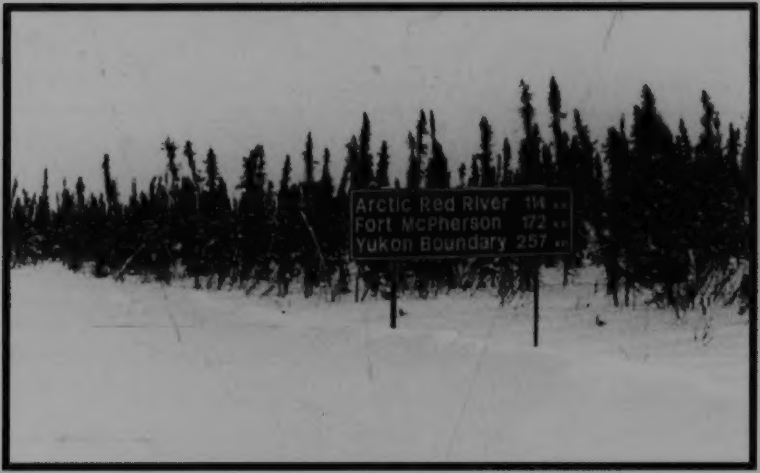

Arctic Red River 114 km
Fort McPherson 172 km
Yukon Boundary 257 km

Figure 16: Dempster Highway Sign #2

4.11 The Communities

Participants refer to several communities in the region. Please refer to a map to locate Fort McPherson, Aklavik, Tuktoyaktuk, and Paulatuk. During the winter months an ice road exists between Inuvik and Aklavik and Inuvik and Tuktoyaktuk. It is built on the Mackenzie River and on the Beaufort Sea and can be quite dangerous. When a participant talks about a 'spin out' or 'flipping', they are referring to this driving experience.

Figure 17: Ice Road to Aklavik and Tuktoyaktuk

4.12 The Profiles

The profiles are organized by grade starting with the participants in grade seven. The profiles were sent to each participant in February of 2000. The participants were encouraged to make any changes, add other information they felt was important, or delete anything they didn't want included and return the profiles to me. Each profile is the result of that collaboration.

4.12.1 Eric

> Eric: *Well I go on the Internet and check my Hotmail, go on chat lines or look up stuff for school or just surf the net.*

Eric is a grade seven student (12 years old) of English heritage. He is the youngest child in his family. His brother lives in Edmonton with his grandmother and is in Grade 11. Eric's sister is in grade 8 at the school. Eric says that "my family used to own a pet store but we had to close it down." His Mom works at the Inuvik Preschool and his Dad is the Information Technology Consultant for the Inuvialuit Development Corporation. Eric was born in Prince George and lived there for a year. He moved to Inuvik ten years ago.

Outside of school, Eric enjoys soccer, playing on the computer and reading. He likes Animorphs and has read thirteen in the series. He likes to rent action movies. All kinds of music interest Eric but he doesn't spend a lot of his time listening to music. Eric says he spends about an hour per day on the computer. He says "I go on the Internet and check my Hotmail, go on chat lines or look up stuff for school or just surf the net." He also spends time playing computer games and his favorites are soccer and hockey.

To find information he uses the Internet or a CD-ROM encyclopedia such as Encarta. He doesn't usually go to the Public Library. He likes the AltaVista search engine and uses the Internet as his first choice for information "because I can use it pretty well I think." He can barely remember a time when he didn't have a computer. He thinks they got their first computer when he lived in his old house before he went to kindergarten. He doesn't watch too much television but does like to watch Fresh Prince of Bel Air and Friends.

He is not really into any winter sports except for indoor soccer. He has traveled to Kelowna, Kamloops, Yellowknife, for Super Soccer (Territorial Championships), Alaska and Edmonton. He has also flown out to Edmonton several times because both sets of grandparents live there.

4.12.2 Paul

> Paul: *We went to Vancouver for drum dancing at the National Kids Festival.*

Paul is a grade seven student (13 years old) of Inuvialuit heritage. He has four brothers and his mother and father both work for the Inuvialuit Communications Society. They are involved in television program production for the Aboriginal Peoples Television Network (APTN). One set of grandparents lives at Aklavik. They have a fur shop and make and sell clothes and crafts. Paul's grandfather does a lot of hunting. His other grandparents moved from Paulatuk to Inuvik. His grandmother was in the hospital because "she has too much pressure. She's got lots of grandchildren and she has been watching them a little too hard and she is getting too sick." Paul was born in Inuvik and he says that he "lived here my whole life but a little bit at Paulatuk".

In his free time, his first priority is "after school I take my homework and go home and do my homework." He plays with his Sony PlayStation and his two favorite games are Metal Gear Solid and Grand Tourismo. Paul said "right after my homework, I go play with my cousin Derrick or go play hockey outside of my house." He likes to watch movies and horror, action and adventure are his favorites. He rents two or three a week and his current favorites are The Mummy and The Matrix.

Paul likes to read "some kind of adventure chapter books". Currently, Paul said "Desire for Gold, that's one book I am reading right now". To use a computer he goes to his dad's workplace where he can search the Internet. Paul has done a lot of travelling recently. He said "a couple of months ago I went to Yellowknife for soccer". He has also done some travelling as a member of the Inuvik Drummers and Dancers Group. He said "we went to Vancouver for drum dancing at the National Kids Festival and after that we went to Fairbanks and Saskatchewan." Paul practices every week as a member of the Dance Group.

During the summer, Paul said "I go out on the land and go hunting with my Dad". They have several family cabins where they go near Aklavik. Aklavik is also a family spot for celebrations and holidays such as Easter. Lots of music interests Paul but currently he likes Limp Bizkit. At lunch time Paul said "my Mom is listening to music on the radio." Sport is another important part of Paul's life. He describes himself as a "good sports player" and especially loves soccer. He also enjoys street hockey with his cousin. Most of all he said, "I love to run around."

Paul talked about being new to the school. He mentioned that he was older than other students in grade seven because "my Mom kept me back in Grade two." He talked quite a bit about the experience and said "that was kind of hard for me cause everyone was calling me a failure but I wasn't, I kept going."

4.12.3 Fran

> Fran: *My mom took me out of that school because it was too strict and she didn't like me wearing that suit.*

Fran is a grade seven student (12 years old) who is a descendent of Gwich'in heritage. Her brother is 17 and he is in high school. Her great, great grandfather was the chief of the Gwich'in culture. The Fort McPherson school is named after him, Chief Julius School. She says that her "Mom doesn't like to tell her age." Her mother works as a counselor to help "other people on their problems." Fran says that her Mom went to school (college and university) for 4 years and then she did her practicum and now she is working. Fran says that she "was born here [Inuvik] and then we went to McPherson. When I got older we moved to Edmonton and then moved back here for a year and when

I was seven we moved to Fort Smith. And then Regina and then Saskatoon and then Edmonton and then we moved back here." Her grandparents live in Fort McPherson.

In her free time, Fran does her homework and "catches up on work that she doesn't do." She loves to read her collection of Little House on the Prairie books. Fran loves all kinds of books. She doesn't spend a lot of time watching television but does like The Simpsons and shows on The Discovery Channel and The Learning Channel. She likes country music and her favorite singer is George Strait. During the week and on weekends, Fran likes to rent movies. Her favorite movie is House on the Hill and she loves horror movies. She doesn't play video games because "my Mom says it stops my head from thinking."

She sometimes uses the computer to work on projects. She remembers a project she did while living in the south on the NWT and Yukon. All of the information was found on the computer and she earned the highest mark in her class. She likes sports and plays volleyball, soccer and basketball. This means at least four or five practices a week. Fran loves to ski and snowboard but doesn't get to do it much now that she lives in Inuvik. She has traveled to Fort Simpson, Ft. Liard, Ft. Norman, Vancouver, and Yellowknife. She uses the Public Library to find information because "they have all the information on the web." Fran also borrows books there.

4.12.4 Carol

> Jennifer: *Do you have a computer at home?*
> Carol: *No. I haven't used them very much and I don't know how to go on anything.*

Carol is a grade seven student (11 years old) of Inuvialuit and Non-Aboriginal heritage. She has five brothers – 1, 4, 8, 9, and 16 years old. Her father is one of the MLAs for Inuvik and her mother stays home. Born in Inuvik, Carol has lived here her whole life. She misses her father when he is in Yellowknife and says that "Dad is gone a lot but I still get to see him".

For fun, Carol likes to read books, pick on her brothers and watch television. Her favorite books are Anne of Green Gables, Goosebumps and Spine Chillers and mystery books. She likes Full House and Mad Libs on television. The family rents movies and own some with teenagers in them. She likes a lot of different kinds of music. Her favorites are Britney Spears, Christina Aguilera, Shania Twain, Back Street Boys, 'N Sync, Kid Rock, Korn and Limp Bizkit. She likes to watch Much Music.

Virtual Cop, Bug, Bug 2 and Road Rash for Sega are her favorite games. She likes to hang out with friends sometimes. She didn't have a computer at home at the time of the study but has since got one and really knows how to use computers. To find information for projects, Carol likes to read books. Carol definitely feels "more comfortable with books than with computers". She likes to go to the Public Library sometimes.

She has driven out a lot to places such as Edmonton, Yellowknife, Whitehorse, Moose Jaw, Regina, and Dawson Creek. During the summer she went to Edmonton and Dawson Creek. On the trip Carol talks about the time when "she walked through this river, it's supposed to be a river. There is a canyon. We built a damn and tried to catch minnows."

She likes being in grade seven at a new school. She likes "getting older and being in a higher grade." At first she "was scared what people would think of me or that I would get hurt." Now she says that the older kids don't pay attention to the younger kids.

4.12.5 Dave

> Dave: *Just stay home and watch TV or go biking.*

Dave is a grade eight student (13 years old) of Inuvialuit heritage. He comes from a large family. He has four sisters and four brothers. His mother works at the post office and his father is laid off right now. He was born in Inuvik and said "I lived here my whole life."

In his free time, Dave likes to "stay home and watch TV or go biking." He loves "skidooing, hockey, road hockey, hanging out and snowball wars." He likes to read "any kind of book I can find." He doesn't watch too many movies but likes television programs such as The Simpsons, Fresh Prince of Bel Air, and Full House. He likes listening to music. Both Nintendo 64 and Sony PlayStation are found in his house but he doesn't play a lot. Instead he plays games on the computer. He likes Tetris, card games, especially poker, and bulldozer. He likes to go the Public Library when he has to find information for a project. He especially likes playing outside with his neighbourhood pals.

He has traveled with his family to Vancouver, Edmonton, Yellowknife, Whitehorse, Aklavik and Fort McPherson.

4.12.6 Ken

> Ken: *If I can't find it on the Internet then I would go to a book*

Ken is a grade eight student (13 years old) of mixed Inuvialuit, Indian and White heritage. He has three brothers, one who is his twin. One of his brothers lives in Edmonton, one lives with his Mom and he and his twin live with his Dad and Step-Mom. His parents own a business in town. Ken was born in Edmonton but has lived in Inuvik for his whole life. He and his twin get along well and he would "like to live somewhere else – anywhere out of the NWT."

During his free time, Ken loves to play sports, including soccer, play kick the can and ride his bike. His favorite shows are The Simpsons, Freaks and Geeks, and Futurama. He doesn't like to read and only goes to the Public Library to work on homework or to look at magazines. On the weekend, Ken watches lots of movies and his favorite two now are Idle Hands and Universal Soldier. He doesn't listen to music that much. He likes video games and has both Nintendo 64 and Play Station and his favorite game is Pod Racer from Star Wars: Episode One. Ken was lucky enough to see the new Star Wars movie while he was in Whitehorse.

Ken has traveled extensively. He has been to California to go to Disneyland and while there also had the chance to go to Tijuana, Mexico. He has also been to Edmonton, Whitehorse and Yellowknife a couple of times. He also went to Las Vegas when he was little.

He has a computer at home and uses that to find information. Ken checks his Hotmail, downloads clips from songs and movies and surfs the Internet a little bit. When looking for information, Ken says "if I can't find it on the Internet then I would go to a book." Ken spends about an hour a week on the computer and about two hours a week playing video games. He spends about 8-9 hours a week watching television and rents at least two or three movies a week.

4.12.7 Lynn

> Lynn: *We thought we were going to stay here for only one year for an adventure. We have stayed here for 9 years.*

Lynn is a grade eight student (13 years old) of Afrikaans heritage. She is the youngest child in her family and has three older brothers. All of her brothers go to school in

Edmonton. Her father is a doctor at the hospital and her mom used to be a teacher but now stays at home. Her mother is involved in church activities. Lynn was born in South Africa in 1986 and lived there until she was 4 ½ years old. When talking about moving to Inuvik, Lynn said "we thought we were going to stay here for only one year for an adventure, we have stayed here for 9 years."

In her free time, Lynn works at a part-time job at the medical clinic. Her duties include restocking the offices, picking up charts, answering the phone, and pulling charts for the next day. On days that Lynn isn't working at the clinic, she also works as a babysitter, does homework and hangs out with friends. She likes to read mysteries but said "with school starting now I don't have much time to read." She spends about 2 or 3 hours a week reading. Lynn uses a computer every day. She said, "I use it every day for typing up reports, research and checking email". Babysitting keeps her very busy. That means she works at least ten hours a week and will work in the evenings during the school week or on weekends until "2 or 3 in the morning".

Her favorite movie right now is Forces of Nature. She listens to music "with friends and at home when I am bored or doing homework." Her favorite CDs are mixed ones like Now 4. She likes television, watches two to three hours per day, and has several favorite shows including Friends, Jesse, Freaks and Geeks, and Just Shoot Me. Lynn has a computer at home. When she is working she spends a little less time on the computer, but averages at least an hour every day. Sherlock and Netscape are her favorite search engines.

Travel has been an important part of Lynn's life. She has been to Namibia and much of Canada and the Western United States. Her family enjoys camping holidays and has visited places such as Colorado for river rafting, Utah, and Mexico. She has also visited almost every province and territory except PEI, Nova Scotia, Manitoba and Newfoundland. This summer Lynn spent some time in Edmonton getting her brothers settled in.

When asked about going to the Public Library, Lynn said, "when my computer's not working I go there, I don't really have time". Any books she wants she usually buys or "when my Mom goes to the library I ask her to get some books for me." Most of Lynn's book purchases are made when in the south on holidays.

4.12.8 Abby

> Jennifer: Do you go to the public library?
> Abby: *I go there with my friend Mandy. Mandy drags me there.*

Abby is a grade 8 student (13 years old) of Gwich'in heritage. She has one brother who is a couple of years older and "likes going out on the land". Abby's mom works for the Government of the Northwest Territories Health and Social Services as a secretary. Abby has a large extended family of aunties, uncles and cousins. Her grandparents live in Fort McPherson and spend much of their time at their camps. Abby said "they go out on the land. They have two campsites." They catch and make dry fish and trap when they have help. Abby used to spend summers with them at their camp when she was younger. She said "from the time I was six or seven mostly every summer I went out on the land." More recently she has only gone for short visits. Once she "dragged Mandy along".

Abby enjoys watching television, listening to music, "drawing and walking around with friends" during her free time. Her favorite television stations are Much Music and Super Channel. She likes all kinds of music but especially Backstreet Boys and Korn. On the weekend, Abby might rent 2 or 3 movies and she sometimes plays video games. She doesn't have a computer at home but uses the one at her mother's office or one at the public library. She goes to the public library to find information and to check her email.

Abby was born in Inuvik. She spent some time living in Fort McPherson and Fort Smith while her Mom went to school. She moved back to Inuvik when she was in grade one. She doesn't read too much and doesn't babysit very often. Abby has travelled to Edmonton, Yellowknife and Whitehorse.

4.12.9 Chris

> Chris: *If my mom thinks I am watching too much TV, she'll tell me to read.*

Chris is a grade nine student (14 years old) of Non-Aboriginal heritage. He moved to Inuvik in grade seven and has an older brother in the school. His parents own several businesses in Inuvik. They own a restaurant and a catering company and his father is an accountant for the Inuvialuit Development Corporation. Chris was born in Nova Scotia and lived in New Brunswick, Edmonton, Kingston, before moving to Inuvik.

In his free time he "watches TV, eats and plays kick the can." His favorite shows are The Simpsons, Pokemon and he likes watching movies on Super Channel and Super Station. He likes to rent movies and video games but it depends on how much money he has. His favorite movie right now is The Mummy. He listens to music at night and right now he likes Prozac, Metallica, Savage Garden and Offspring. His favorite game is Monster Truck Madness on Nintendo 64. Chris and his brother buy games and then trade them with friends.

Chris helps out with his parents' businesses on weekends. He helps "unloading stuff but doesn't get paid for that." They have four computers at home. Chris said "my computer is slow and my brother's computer doesn't have colour so we goes to my Dad's computer." He uses the computer for games, the Internet and for Hotmail. He only checks his mail about "once a month." Chris sometimes uses the computer for school projects. When he is thinking about something or wondering about something he just goes on the Internet to check it out.

Chris doesn't read too much but when his mom thinks he is watching too much television she'll tell him to read. Chris sometimes goes to the Public Library after school. Usually, Chris has a very specific plan for after school. This includes three episodes of The Simpsons, Full House, a movie on Super Channel and some Much Music. Then it is time to go out and play. He says that "usually I don't have homework" and "sometimes I purposefully forget it there [at school] because I don't want to have to do homework".

His favorite authors are R. L. Stine, Bob Colville and comic books such as Archie and Beetle Bailey. He is really into sports and loves hockey and volleyball and sometimes goes public skating (free skating at the arena). His dad used to be President of Inuvik Minor Hockey Association but this year Chris didn't want to play because the family is getting a new skidoo.

He has been to Tuktoyaktuk, Aklavik and Fort McPherson. Last year on the ice road "they got into a spin but didn't flip." Chris has never been on a plane or only maybe once when he was about two. The family drove down to Edmonton and back without a flat tire. His Dad recently flew to Whitehorse.

4.12.10 Bob

Bob: *I thought I would be living in a cabin or an igloo.*

Bob is a grade nine student (14 years old) of Non-Aboriginal heritage who was born in California and lived there his whole life. Bob moved to Inuvik two and a half months ago with his father to help out with his uncle's businesses. He has been helping out at his uncle's café as a part-time job. It was the first time he has seen snow and he felt the people were different and new. Bob lived most of his life with his Mom but lived with his Dad in California for the past couple of years. His mother is remarried and he has an older sister who has graduated from high school.

He was born in Pasedena in Orange County and enjoyed going to the beach and to parties with friends. He went to a "7-12 school with a large football field, baseball diamonds and a pool." He played waterpolo there. Bob "only reads books that interest him." He likes "Science Fiction, but not all of it." His favorite author is Arthur C. Clarke. He used to go to the movies almost every Friday night. Special effects movies are great and his favorite movies right now are The Matrix and Star Wars: Episode One. He spends a lot of time watching television, two-three hours per night. His favorite shows are The Family Guy and X-Files.

Bob enjoys video games and is hoping "to get a Sony PlayStation for my birthday." His favorite game right now is Tekken 3 but for all time it is Asteroids. He had a computer in California – an iMac - but doesn't have one in Inuvik. He has done some travelling in the southern United States including Arizona, New Mexico, Texas and Nevada and once visited Vancouver Island and he has some relatives in Sherwood Park.

When looking for information, Bob used Encarta at a friend's house. "I print out a picture and the information and then put it in my own words." To find information successfully, Bob suggests using shortcuts that make it faster and learning to navigate and use back buttons. He uses the public library to check his email. His uncle says he is really good with computers. This is high praise as his uncle owns a graphics business.

Bob finds school in Inuvik to be more challenging and fun. He says that there is very little difference between his school in California and this school in terms of drugs and violence. He has made some new friends and seems to be fitting in very well. He thought it would be very different living in Inuvik. He seems well prepared with a new pair of Sorel winter boots and some thermal socks that are rated at –32°C.

Bob taught himself to play the guitar about three years ago and is interested in 80s punk music. He listed several bands that he liked including The Dead Kennedys. He said he plays "other stuff – I don't play country but soothing music."

4.12.11 Mary

> Jennifer: Do you enjoy reading?
> Mary: *Sometimes when I am bored.*

Mary is a grade nine student (14 years old) of Inuvialuit heritage. She is the oldest child in her family and has a younger brother and sister. Her father works for Aklak Air and her mother works at this school. Mary said that "my sister is in grade 7 so is my brother." Her grandma works at the Transition House and her grandpa works at the hospital. She was born in Inuvik and lived in Tuktoyaktuk when she was little for about 6 years. She has "just lived in Tuk (Tuktoyakuk) and here."

In her free time, Mary enjoys "walking around with my friends and going on trips with my family." Television isn't an important part of her life, she only watches about ½ an hour per day. The family might rent a couple of movies per week. Her video game system is Nintendo 64 and her favorite game is MarioKart 64. Mary has a computer at home and uses it for typing out homework. It isn't hooked up to the Internet so Mary doesn't use it very much. When asked whether she enjoys reading, Mary said, "sometimes when I am bored."

In the summer, Mary helped her grandmother with babysitting. The summer is also family vacation time and Mary has been to Edmonton at least four times. They drive out from Inuvik and she likes to go shopping at the malls in Edmonton. Mary's favorite bands are Vengaboys, Lou Bega, and Prozzak and she enjoys watching Much Music. Sports are very important for Mary. Currently she is playing volleyball and soccer and that means four practices a week. Homework is another important part of her life and she spends about 11/2 hours per night doing her schoolwork.

4.12.12 Sue

> Sue: *I have 6 pets now, 3 rodents, and 2 birds and a dog.*
> Jennifer: And the rodents and the birds get along?
> Sue: *Separate cages, same room, but they really don't like each other that much though.*

Sue is a grade nine student (14 years old) of mixed Cree and German heritage. She has two brothers who are 16 and 12. Her father is an artist but "he used to be a wrestler." She has a large extended family with "two grandmas, one grandpa and lots of cousins". She lives with her mother, who works for the government, and a menagerie of pets including "3 rodents, and 2 birds and a dog." Her "Dad and brothers live in St. Louis, Missouri." She was born in Edmonton and "lived there in a blue and white house near where they have Klondike Days." From 1989 to 1993 she lived with her "Dad and little brother until 1993 when my Mom came and picked me up." She loves to visit her Dad "when she has the chance." But it is very expensive and so when she goes she stays for about three weeks.

Sue has a part-time job working at the Drug Store. She works there about 15 hours per week. Some of that time is after school and some is on the weekend. When she finishes work or gets home from school she walks her dog, does her homework, watches television (she loves wrestling), or goes to Cadets. She has the Nintendo 64 video game system and Extreme Jeep is her favorite game. When it comes to movies, Sue likes "anything that doesn't put me to sleep." Movies she enjoyed included Big Daddy, Austin Powers and American Pie. She rents about two movies per week.

WWF is her favorite television program but she also watches Much Music, Futurama and That 70s Show. She likes Korn and Limp Bizkit. Sue has a computer at home but it is "slow" and is used only for games, typing and Encarta. It doesn't have Internet access. Her favorite authors are Stephen King and V. C. Andrews. In the summer she went to Whitehorse Cadet Camp, to St. Louis for 3 weeks and to Edmonton for two weeks. In Edmonton they stayed in a hotel downtown and her "cousin came from Lac La Biche." Other travelling has included Iqaluit and Cambridge Bay for Cadets, the area in and around St. Louis, Lac La Biche and around Edmonton.

4.13 Key Informants

Mrs. K teaches grade nine Math, grade 10 Math, and Junior High Computers. She has lived and worked in Inuvik for over 25 years. She is married and has two sons. Ms. A. is a Special Needs Assistant/Library Assistant. She works one-on-one with an autistic boy for part of the day. She has lived in Inuvik for three years. Ms. B. teaches grade eight Social Studies, Language Arts, Health and Art. She is married and has lived in Inuvik for four years. Mr. I. teaches grade seven Social Studies, Language Arts, Health and Physical Education. He has lived in Inuvik for most of his life. His father was in the Canadian Armed Forces and Mr. I. went to junior high and most of high school at SHSS. He returned to Inuvik to teach after university. He has been teaching in Inuvik for 10 years.

4.14 Chapter Summary

This chapter explored the research context and then presented profiles of the participants and brief background information on the key informants. The research context included an introduction to the town of Inuvik, the Inuvik Centennial Library, Sir Alexander Mackenzie School, and Samuel Hearne Secondary School. A brief discussion of the senior high, junior high and the study location in SHSS followed. An introduction to the profiles and some of the terminology used by participants preceded the profiles. The profiles are the result of an initial interview and further consultation with the twelve participants. At the end of the chapter, there is a section briefly describing the four key informants.

CHAPTER 5

FINDINGS

5.1 Introduction

This chapter presents an in-depth explanation of the information-seeking processes of the twelve participants. This explanation will include examples from the participants Think Alouds and Think Afters as well as screen captures from the two CD-ROM encyclopedias. Each search will be carefully detailed. The same four questions were answered by all of the participants in Search Session 1. In Search Session 2, participants answered questions based on their Social Studies curriculum. The grade seven participants answered questions on Alaska, the grade eight participants answered questions on Egypt and the grade nine participants answered questions on inland Canadian waterways and geography. In Search Session 3, participants asked their own questions of the CD-ROM encyclopedias. These questions were varied and included questions such as the following:

- Who invented hockey?
- Who invented baseball?
- Who invented computers?
- Who invented Rugby?
- Who won the first World Cup?
- How does an electric guitar work?
- Which team won the most Stanley Cups?
- When was Anne of Green Gables written?
- What is a dugong?
- What is the most populated country in the world?
- What is the length of the Mackenzie River?
- What is a duck-billed platypus?
- What is in rocket fuel tanks?
- Who designed the Canadian flag?

The chapter also includes the findings from the key informant interviews and a discussion of the three dissertation questions.

5.2 Search Session 1

Each of the twelve participants wwas asked the same four fact-based questions in the first search session. The participants explored some of the features of each CD-ROM encyclopedia before the questions were asked. This included looking at the find box, related articles, multimedia, back button, world maps, article outline, symbols, quick facts, and a timeline. Some of the participants managed to find the answers to the questions quite quickly; others needed more time. Table 1 shows the amount of time, in minutes and seconds, needed to answer each question.

Table IV: Time Needed to Find Answers in Search Session 1

Name	Who was the first woman in space?	Describe the cardinal, a bird.	Who was the first man in space?	Describe the boxer, a dog.
Eric	05:15	01:16	11:47	01:41
Paul	25:23	05:02	01:43	00:56
Fran	12:42	02:12	13:38	03:36
Carol	04:27	02:00	05:24	04:10
Dave	05:14	01:21	09:47	01:32
Ken	07:10	00:52	04:41	00:21
Lynn	00:45	00:42	04:11	00:56
Abby	21:20	02:52	13:30	02:03
Chris	07:38	00:42	22:22	00:40
Bob	03:19	00:42	10:50	07:10
Mary	01:37	00:34	07:40	01:16
Sue	01:16	00:40	14:50	00:32

A summary of the initial search terms for all four questions in the first search session is included in Table V.

5.2.1 Initial Search Terms - First Woman in Space

The first question was who was the first woman in space. Two participants used the phrase *first woman in space*, one used *space, first woman* one used *woman in space* and three used *space* as their initial search terms. Three other search terms were also used. Paul used *astronaut*, Chris used *space geographers* and Bob used *space shuttle*. Dave and Ken both used the original question *who was the first woman in space* as their initial search term.

When asked in the Think Afters about their choice of initial search term, participants had a variety of responses. Eric commented that "[*woman in space*] seemed like the main part of that [the question]." Paul commented that going to "[*astronauts*] tells you about space. It tells you about shuttles and all the other stuff." Fran typed *space* "because it was the main thing." Carol typed *space* "'cause that's where I thought it would be." Dave typed in the whole question "to find out who the first woman in space was." Lynn used *space, first woman* and said she got the idea from her grade seven teacher. She explained "Well, from in, um, in our Language Arts classes if we're looking for specific topics, um, I remember that last year that we always put stuff in quotations." Abby typed in *space* to find "just stuff that might go to it [the answer] or, um, or attaches to it or something." I asked Mary what was it about the phrase first woman in space. She answered, "It is just what you said. I just typed it in." I asked Sue in the Think Afters why she had not chosen woman or space. She answered "because woman could come up with anything and so could space." Sue also had thought far enough ahead that she was going to "check *astronauts*" if *first woman in space* did not work.

Table V: Initial Search Terms in Search Session 1

Name	Who was the first woman in space?	Describe the cardinal, a bird.	Who was the first man in space?	Describe the boxer, a dog.
Eric	*Woman in space*	*Cardinal*	*First man in space*	*Boxer dog*
Paul	*Astronaut*	*Birds*	*Astronauts*	*Boxer*
Fran	*Space*	*Types of birds*	*Space*	*dogs*
Carol	*Space*	*Birds*	*Space*	*Dogs*
Dave	*Who was the first woman in space*	*Cardinal*	*First man in space*	*What a boxer dog looks like*
Ken	*First woman in space*	*Cardinal*	*First man in space*	*Boxer*
Lynn	*Space, first woman*	*Cardinal, bird*	*Space, first man*	*Boxer appearance*
Abby	*Space*	*Cardinal bird*	*Space*	*Boxer dog*
Chris	*Space geographers*	*Cardinal*	*First man in space*	*Boxer dog*
Bob	*Space shuttle*	*Cardinal*	*First man in space*	*Dogs*
Mary	*First woman in space*	*Cardinal*	*First man in space*	*Boxer*
Sue	*First woman in space*	*Cardinal*	*First man in space*	*Boxer (dog)*

During the Think Alouds, Chris said,

> I am thinking what it would be under. It wouldn't be under space 'cause there is just space. Um. Let me think. Space technology. Oh God.

> Sometimes I would ask what it would be under so it is kinda hard right now. Would it be under space geographers?

In the Think Afters, Chris said he was "looking for people in space not space and what's out there." Chris said he would "ask if, what the category would be because sometimes I don't know the specific name of it." Bob, in his Think Aloud, said immediately after I asked the question, "I'm thinking about the space shuttle crash back in 1985. So I am going to type in space then space shuttle. I am also looking for the name of the spacecraft." Bob introduced his background knowledge about the question in the Think Alouds. He also said "There was a woman on it [the space shuttle crash] – she was a teacher or something." This was very interesting because Bob was the only participant who mentioned any background knowledge during this search. Bob had just moved to Canada from the United States. In the Think Afters, I asked Bob if he was looking for something in particular. He said, "Yeah, like I was thinking, uh, that one Freedom 7 was. Because I know there's a couple of teachers, her [Christa McAuliffe] and two others."

5.2.2 Initial Search Terms – Cardinal

The second question was describe the cardinal, a bird. Seven of the participants chose *cardinal* as their initial search term. There were several other variations as well. Lynn typed *bird, cardinal* and Abby typed *cardinal bird.* Two participants, Paul and Carol, used either bird or birds and Fran used *types of birds* as her initial search term. Fran clarified her thinking after hearing the question. "A bird. What a cardinal looks like? Okay. That should be as hard as this one [the first woman in space]. I'm looking for a cardinal and she said it is very easy but it's not." I asked Ken if he thought of typing anything else or did he know right away he was going to type in *cardinal*? He said he "was going to type in what a cardinal looks like but I just put cardinal." When I asked him how come? He said because it was "easier."

Lynn had good success using *space, first woman* as the search term for her first question. After this question, she said, "I don't know if this [*bird, cardinal*] is going to work but I will try it again." Chris said, "I have heard of that [cardinal]" when I asked him the question. He continued to use his background knowledge as he did the Think Aloud. He said "Oh, I've seen one of those in a book though and on my clock. I have a clock of that. I think he is six o'clock." I asked him in the Think Afters, if he though about typing in bird. He said "No. Because birds, there's so many birds. Typing in cardinal would be more specific." Bob, in the Think Alouds, said, "I'm not that good at spelling but… cardinal bird." I asked him if thought of searching using the term *bird*." He said, "I know that would take too long. Like it would be the same thing as just typing in space on the last question and finding all that stuff." I asked him if he was sure there would be an article and he said "Yeah."

In the Think Afters, I asked Mary why she chose *cardinal* as her initial search term. She said she knew it was a bird but did not even think to type in bird. Sue also knew it was a bird and did not think of typing in *bird* because there are "too many birds." Paul in his Think Aloud immediately used his background knowledge about the cardinal. He said, "They're red. I used to like their team for baseball. They're black, they're red and black, they have black eyes, they look like blue jays, kind of." He decided to use the search term *birds* because "Birds would be better cause it might get the cardinals baseball players."

5.2.3 Initial Search Terms - First Man in Space

The third question was who was the first man in space. Seven of the participants typed in *first man in space*. Paul used *astronauts* again. Fran and Abby used *space* again. Lynn used the inverted *space, first man* like she did in the first [*space, first woman*] and the second [bird, cardinal] questions. Carol tried *people in space*. Although *first woman in space* and *space, first woman* were very effective ways of locating the answer in Microsoft Encarta Encyclopedia Deluxe 2000, typing in *first man in space* or *space, first man* resulted in no topics found in 1999 World Book (Deluxe). In the Think Alouds, many of the participants responded to not being able to locate a list of topics. Eric said, "If it was the first man on the moon it might be the first man in space." Lynn said, "that isn't going to work" after getting no topics found after her initial search term.

After hearing the question, Chris used his background knowledge in the Think Alouds. He said, "Neil Armstrong was the first one on the moon, right?" Even as he typed in *first man in space*, Chris was saying, "I'm not sure if it's as good." He then continued "Okay, mm, would he be the first astronaut, first astronaut." Bob clarified the question right away by asking "Not on the moon but in space?" when *first man in space* did not find any topics. This did not work because 1999 World Book (Deluxe) did not retrieve any articles with *first*, *man*, and *space* in one sentence. When Carol typed in *people in space*, she was immediately given the space exploration article. With Fran, her frustration appeared immediately after the no topics found text box came up. She said, "First man? Why couldn't we just go to the other one [Microsoft Encarta Encyclopedia Deluxe 2000]? You didn't help me last time. Space. Watch me go all the way through again. Ever bomber." Abby also typed in *space* as her initial search term and went directly to the space exploration article. Abby was "trying to look for something that might talk about the first man in space."

5.2.4 Initial Search Terms – Boxer

The fourth question was describe the boxer, a dog. Three participants used *boxer*, three participants used *boxer dog*, and three participants used either *dog* or *dogs* as their initial search term. Lynn used *boxer appearance* and Sue used *boxer (dog)*. Dave used the actual question *What a boxer dog looks like*. Paul was sure that typing *boxer* was the correct approach. He said, "It's going to have a lot of things in it." Fran began to use her hands to describe a boxer. She said "It looks like this and it has a little short tail and it's kinda like a Rottweiler except it's really cuter. We used to have one. And now we have a Rottweiler." Carol asked, "Are those those little cute flat nose?"

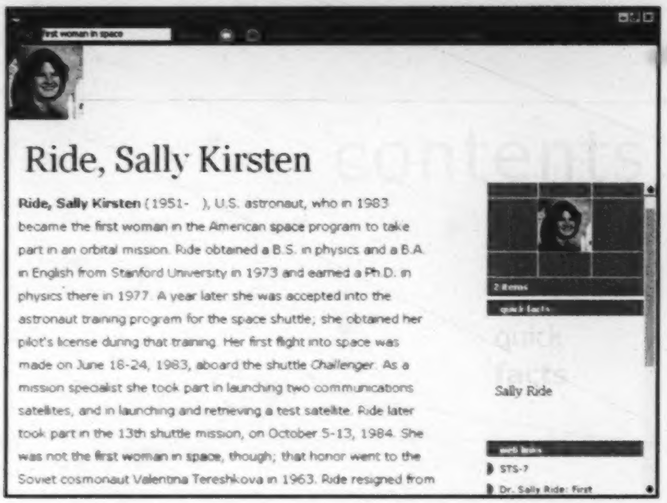
Ken also had a lot of background knowledge that he brought to the Think Alouds. He said, "Really skinny. My next door neighbour used to have one. Skinny. Small paws. It has a wrinkly face." When asking for clarification, Abby wanted to know if the words *boxer* and *dog* were "attached or apart?" Chris used *boxer* as his search term. When I asked if that was the same reason he didn't think of using birds, he said "nah, too many dogs." Bob, in the Think Alouds, asked, "Do you know if the boxer dog has a different name?" Mary was very straight forward in answering why she typed the word *boxer* as her search term. She said "Because you asked the question about a boxer." Sue provided an interesting reason for typing *boxer (dog)* as her initial search term. She said, "Because if you just typed in boxer it may come up with Mike Tyson or something like that." When asked where she had seen brackets used, Sue said "just because some of the other things like they have specific dates."

5.2.5 Information-seeking Processes - First Woman in Space

The next sections describe, in detail, the information-seeking processes of the participants during Search Session 1. Most of the participants had difficulties finding the answer to the first question. The average amount of time spent on the question was just over 8 minutes. The range was from 45 seconds to over 25 minutes. It is interesting to see some of the different approaches to finding the answer.

Eric's first search term was *woman in space* and he got a large number of articles containing those search terms. To narrow the search, he added first to the search term to create *first woman in space*. He clicked on several of the names on the list, methodically working alphabetically from top to bottom. In the Think Alouds, when he found out information after reading, he would make a statement. These statements included things like "I am going to see this one", "She was one of the first six [women in space]", "I'm going to the next one", and "I am going to go back again." He found the answer in the article on Sally K. Ride who "wasn't the first woman in space." In the article he found out that "Tereshkova was the first woman in 1963." Figure 18 shows the search screen where Eric located the answer.

Figure 18: Sally Ride Article in Microsoft Encarta Encyclopedia Deluxe 2000



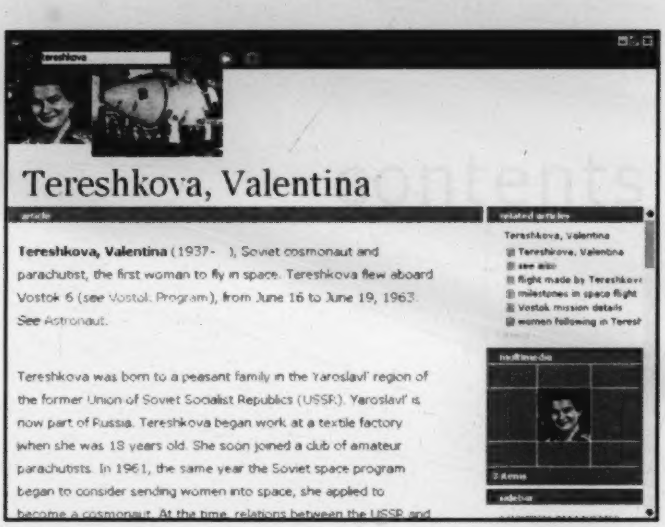
Ride, Sally Kirsten

Ride, Sally Kirsten (1951-), U.S. astronaut, who in 1983 became the first woman in the American space program to take part in an orbital mission. Ride obtained a B.S. in physics and a B.A. in English from Stanford University in 1973 and earned a Ph.D. in physics there in 1977. A year later she was accepted into the astronaut training program for the space shuttle; she obtained her pilot's license during that training. Her first flight into space was made on June 18-24, 1983, aboard the shuttle *Challenger*. As a mission specialist she took part in launching two communications satellites, and in launching and retrieving a test satellite. Ride later took part in the 13th shuttle mission, on October 5-13, 1984. She was not the first woman in space, though; that honor went to the Soviet cosmonaut Valentina Tereshkova in 1963. Ride resigned from

In the Think Afters, Eric talked about narrowing down his search after getting "lots" of articles to go through. The new search term, *first woman in space*, gave him a manageable number of articles to go through. He started with the first woman's name and worked his way through the list scanning through articles and using the yellow highlighted search terms as a guide. Eric said "I was just going to go down the list one at a time."

Paul's search was quite different. He began with the search term *astronaut* and located many articles with the term astronaut in them. He clicked on the article entitled astronaut. The encyclopedia immediately took him to Mae Jemison who was the "first African-American woman in space." Paul looked at the sections of the article including What do astronauts do? and Astronaut selection. He also discovered related articles. He saw sections of Cosmonauts and the moon and wanted to know "Do I read this all?" He found a section on early astronauts and found Yuri Gagarin and John Glenn. Paul read that "he is famous for 1921 US senator and astronaut and he also became the oldest person to go into space." He spent a lot of time in the astronaut article reading about the Columbia space shuttle and the first U.S. astronaut in space. He typed in *first woman in space* and got the same list of topics that Eric also found. He tried Anna Lee Fischer and read a little about her. He tried Shannon Wells Lucid, Judith Resnick and spent quite a bit of time in space exploration, before finally reading about Valentina Tereshkova. Figure 19 shows the search screen where Paul located the answer to the question.

Figure 19: Tereshkova Article in Microsoft Encarta Encyclopedia Deluxe 2000



Tereshkova, Valentina

Tereshkova, Valentina (1937-), Soviet cosmonaut and parachutist, the first woman to fly in space. Tereshkova flew aboard Vostok 6 (see Vostok Program), from June 16 to June 19, 1963. See Astronaut.

Tereshkova was born to a peasant family in the Yaroslavl' region of the former Union of Soviet Socialist Republics (USSR). Yaroslavl' is now part of Russia. Tereshkova began work at a textile factory when she was 18 years old. She soon joined a club of amateur parachutists. In 1961, the same year the Soviet space program began to consider sending women into space, she applied to become a cosmonaut. At the time, relations between the USSR and

Throughout the Think Aloud, Paul asked questions such as "Can I put first lady in space?", "Can I put first astronaut woman in space?", "Should I try her?", "Where was she from?", "Is that it"?, "What is astronautics?", and "Do you think there is anything on this page?" In the Think After, Paul talked about how he scanned through the large article on astronauts. He said "I was kind of reading a little bit fast through it trying to find a name or something about first woman." When we watched the video tape and he did see Valentina early in his search he said, "I didn't think that Valentina was a girl's name." When I asked him about the time spent looking at seemingly unrelated topics he said "I was looking at some of the stuff because I was interested." He continued that he has "a book at home about space. It's a really big book. My dad got it really long ago."

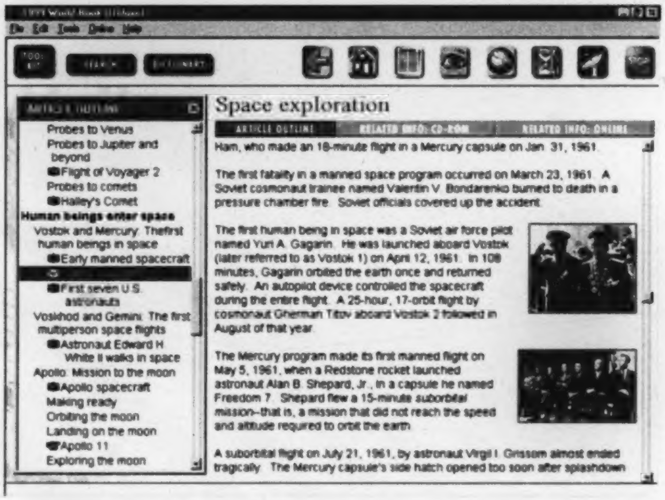
Fran began her search with the term *space*. This term automatically takes the participant to the space exploration article. It was a very long article so she asked the question "Would it give me information if I typed in first human in space?" Fran then tried *female astronaut* and *space voyagers* which both found no topics. The frustration became apparent when she said, "I think I need help. How could I find this?" She then decided to try *space* again and spend some more time looking in the article. She opened the article outline and saw the heading important dates in the history of space exploration. The answer was in that section but she concluded after only a few seconds "This is just the dates."

Fran was sure she had seen the woman on television. Fran continued to be frustrated and asked me "Is it on here? Did you already look it up?" I encouraged her to keep looking and soon she found the heading human beings enter space in the article outline. She became quite excited and said,

> This is the one I passed, right? I think. The first human being in space. Oh, right here, I saw a female right here. Oh. I bet it is in this. Now okay. Those are animals. No people yet.

She continued to scan the section on first human beings in space until she found Valentina Tereshkova. At the end she stated "That took a long time." Figure 20 shows the article outline in the Space exploration article.

Figure 20: Space Exploration article in 1999 World Book (Deluxe)


Space exploration
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE
Probes to Venus
Probes to Jupiter and beyond
Flight of Voyager 2
Probes to comets
Halley's Comet
Human beings enter space
Vostok and Mercury: The first human beings in space
Early manned spacecraft
First seven U.S. astronauts
Voskhod and Gemini: The first multiperson space flights
Astronaut Edward H. White II walks in space
Apollo: Mission to the moon
Apollo spacecraft
Making ready
Orbiting the moon
Landing on the moon
Apollo 11
Exploring the moon

Ham, who made an 16-minute flight in a Mercury capsule on Jan. 31, 1961.

The first fatality in a manned space program occurred on March 23, 1961. A Soviet cosmonaut trainee named Valentin V. Bondarenko burned to death in a pressure chamber fire. Soviet officials covered up the accident.

The first human being in space was a Soviet air force pilot named Yuri A. Gagarin. He was launched aboard Vostok (later referred to as Vostok 1) on April 12, 1961. In 108 minutes, Gagarin orbited the earth once and returned safely. An autopilot device controlled the spacecraft during the entire flight. A 25-hour, 17-orbit flight by cosmonaut Gherman Titov aboard Vostok 2 followed in August of that year.

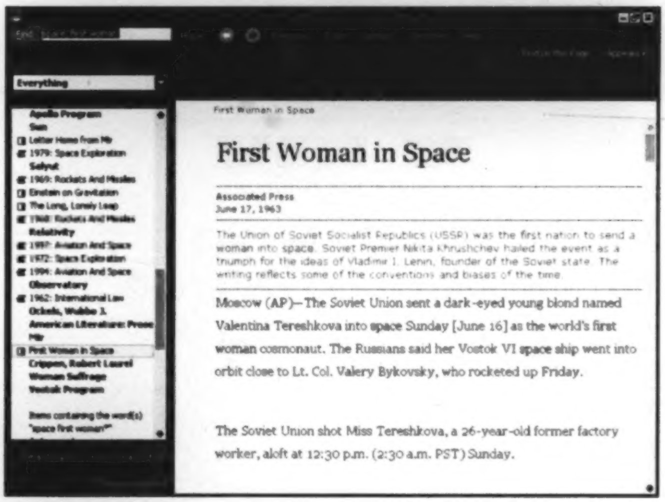
The Mercury program made its first manned flight on May 5, 1961, when a Redstone rocket launched astronaut Alan B. Shepard, Jr., in a capsule he named Freedom 7. Shepard flew a 15-minute *suborbital mission*–that is, a mission that did not reach the speed and altitude required to orbit the earth.

A suborbital flight on July 21, 1961, by astronaut Virgil I. Grissom almost ended tragically. The Mercury capsule's side hatch opened too soon after splashdown

In the Think Afters, Fran reported that she decided to search *space* "because it was the main thing." She was frustrated when the space exploration article was "so long." Fran said she expected to find the answer quickly because "I am good at finding stuff in encyclopedias." She explained that the answer would have been easier to find in a print encyclopedia because "It [CD-ROM encyclopedia] doesn't have it paged like it [print encyclopedia] would. It [print] would have said space, first woman or something like that." She knew that it was not going to be called first person because "they're called astronauts. Because I always knew that." When she found the section on Important Dates in the History of Space Exploration, she did not think the answer was going to be in it. She thought it was "the landing and stuff." Even when she found the section on Human Beings Enter Space, she "wasn't sure because it was all men so maybe it would have been men and not women."

Lynn found the answer to the question in about one minute. She used the initial search term *space, first woman* and clicked on the first woman in space article. The article was a reprint from a news article and Lynn didn't read the whole thing. She scanned the first few sentences and said "Nikita Kruschev" as her first answer before she self corrected and said Valentina Tereshkova. In the Think After, Lynn recalled looking for specific topics last year in grade seven and used the inverted approach she learned then. She thought Nikita was a woman's name from television experience, that is, Nikita is a television show. Figure 21 shows the screen where Lynn found the answer to the question.

Figure 21: First Woman in Space Article in Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Apollo Program
Sun
Letter Home from Mir
1979: Space Exploration
Salyut
1969: Rockets And Missiles
Einstein on Gravitation
The Long, Lonely Leap
1960: Rockets And Missiles
Relativity
1997: Aviation And Space
1972: Space Exploration
1994: Aviation And Space
Observatory
1962: International Law
Ockels, Wubbo J.
American Literature: Prose
Mir
First Woman in Space
Crippen, Robert Laurel
Woman Suffrage
Vostok Program
Items containing the word(s) "space first woman"
First Woman in Space

First Woman in Space

Associated Press
June 17, 1963

The Union of Soviet Socialist Republics (USSR) was the first nation to send a woman into space. Soviet Premier Nikita Khrushchev hailed the event as a triumph for the ideas of Vladimir I. Lenin, founder of the Soviet state. The writing reflects some of the conventions and biases of the time.

Moscow (AP)—The Soviet Union sent a dark-eyed young blond named Valentina Tereshkova into space Sunday [June 16] as the world's first woman cosmonaut. The Russians said her Vostok VI space ship went into orbit close to Lt. Col. Valery Bykovsky, who rocketed up Friday.

The Soviet Union shot Miss Tereshkova, a 26-year-old former factory worker, aloft at 12:30 p.m. (2:30 a.m. PST) Sunday.

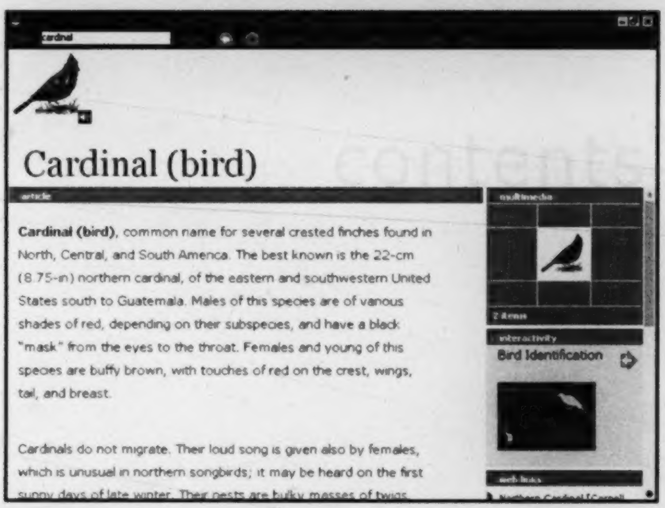
Mary and Sue also found the answer quickly using the initial search term *first woman in space*. Dave used the original question as his search term. When that did not find what he was looking for, he tried *the first woman in space*. He got a short list of names and clicked on Judith Resnick first. He followed the same pattern as Eric, clicking on each name on the list starting at the top until clicking on Valentina Tereshkova.

5.2.6 Information-seeking Processes - Cardinal

The participants found the answers to this question quite quickly. The average amount of time in minutes needed to find the answer was just over 1 ½ minutes. The range was 34 seconds to just over 5 minutes. It is interesting to look at a couple of the different approaches to finding the answer.

Most of the participants began with the initial search term *cardinal*. After typing in the search term, a list of topics including cardinal (bird) came up in the topics list. Most of the participants read the article aloud to me rather than looking at the picture to answer the question. All of the participants did look at the picture or click on the picture and listen to the call of the cardinal. Figure 22 shows the search screen where most of the participants found the answer.

Figure 22: Cardinal Article in Microsoft Encarta Encyclopedia Deluxe 2000



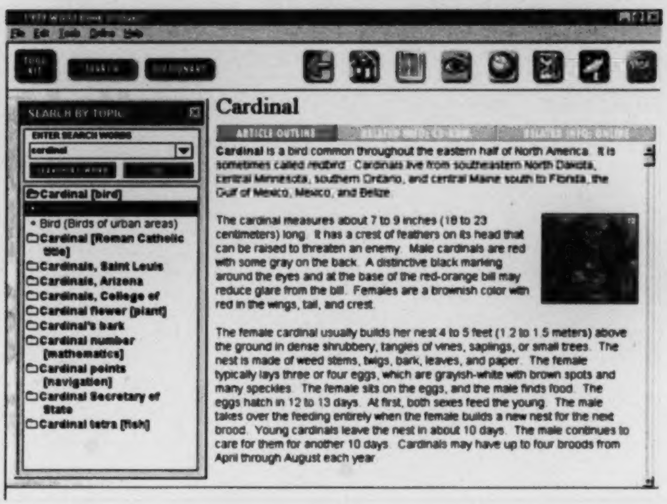
Cardinal (bird)

Cardinal (bird), common name for several crested finches found in North, Central, and South America. The best known is the 22-cm (8.75-in) northern cardinal, of the eastern and southwestern United States south to Guatemala. Males of this species are of various shades of red, depending on their subspecies, and have a black "mask" from the eyes to the throat. Females and young of this species are buffy brown, with touches of red on the crest, wings, tail, and breast.

Cardinals do not migrate. Their loud song is given also by females, which is unusual in northern songbirds; it may be heard on the first sunny days of late winter. Their nests are bulky masses of twigs

Three of the grade seven participants used the initial search term *bird*, *birds* or *types of birds*. Carol typed in *bird* and got a list of topics. She skimmed through the list seeing topics such as bird shot, bird songs and bird dog. Carol then typed in *cardinal* and found the answer quickly. When I asked her in the Think Afters why she chose to start with *bird*, she said it worked last time with *dogs* as the initial search term. She also indicated that if she had to search for the answer to the same question in a print encyclopedia she would look under birds. Figure 23 shows the search screen where Carol found the answer to the question.

Figure 23: Cardinal Article in 1999 World Book (Deluxe)



Cardinal [bird]
- Bird (Birds of urban areas)
- Cardinal [Roman Catholic title]
- Cardinals, Saint Louis
- Cardinals, Arizona
- Cardinals, College of
- Cardinal flower [plant]
- Cardinal's bark
- Cardinal number [mathematics]
- Cardinal points [navigation]
- Cardinal Secretary of State
- Cardinal tetra [fish]

Cardinal

Cardinal is a bird common throughout the eastern half of North America. It is sometimes called *redbird*. Cardinals live from southeastern North Dakota, central Minnesota, southern Ontario, and central Maine south to Florida, the Gulf of Mexico, Mexico, and Belize.

The cardinal measures about 7 to 9 inches (18 to 23 centimeters) long. It has a crest of feathers on its head that can be raised to threaten an enemy. Male cardinals are red with some gray on the back. A distinctive black marking around the eyes and at the base of the red-orange bill may reduce glare from the bill. Females are a brownish color with red in the wings, tail, and crest.

The female cardinal usually builds her nest 4 to 5 feet (1.2 to 1.5 meters) above the ground in dense shrubbery, tangles of vines, saplings, or small trees. The nest is made of weed stems, twigs, bark, leaves, and paper. The female typically lays three or four eggs, which are grayish-white with brown spots and many speckles. The female sits on the eggs, and the male finds food. The eggs hatch in 12 to 13 days. At first, both sexes feed the young. The male takes over the feeding entirely when the female builds a new nest for the next brood. Young cardinals leave the nest in about 10 days. The male continues to care for them for another 10 days. Cardinals may have up to four broods from April through August each year.

Fran used the initial search term *types of birds*. After getting the correct spelling of birds, she got a list of topics and the bird article immediately came up. Fran spent some time looking at the bird article and using the article outline. The outline included topics on How Birds live, Migration, and Bird Study. Fran stated, "I am going to start from the top and this time I am going to read. Would this give me anything?" This followed from the previous search where she missed finding the answer because she did not read the whole section. She continued in her Think Aloud saying,

> Maybe I never read far enough. These are extinct. Did I pass it? So you haven't looked it up? I am just going to go through this. This is a long article. I think I am just going to go back. To something that gives me more information.

Fran started a new search using the search term *cardinal* and found the answer to the question right away. When asked why she started with birds, Fran replied "because it is a bird."

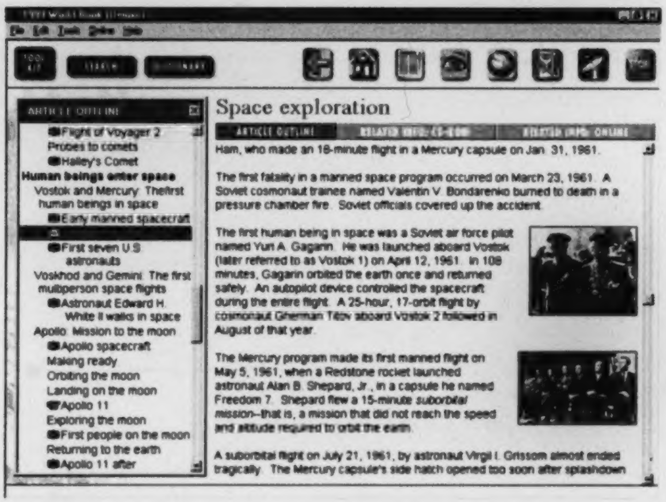
Paul typed in *bird* as his initial search term. He had a lot of background information about the cardinal and felt that "birds would be better [as a search term] because it might get the Cardinals baseball players". He got a list of topics and clicked on bird identification right away. Bird identification is a game in Microsoft Encarta Encyclopedia Deluxe 2000 that allows users to hear a song, see a silhouette and then guess what bird it might be from a list of six possible choices. Paul played the game for a few minutes identifying the crane and the scarlet tanager and then clicked back to the list of topics. In the list he found cardinal (bird) and clicked on the article. The answer came up immediately and Paul read from the article to answer the question.

5.2.7 Information-seeking Processes - First Man in Space

Seven of the participants used the initial search term *first man in space* to find the answer. Unfortunately, in 1999 World Book (Deluxe), there are no articles with *first man in space* in one sentence. While Microsoft Encarta Encyclopedia Deluxe 2000 searches for words in an article by default, 1999 World Book (Deluxe) searches for the word or phrase within one sentence by default. This was quite frustrating for several of the participants. The average amount of time in minutes to locate the answer was just over 10 minutes and the range was from 1 ¾ minutes to almost 22 ½ minutes. It is interesting to look at several of the different ways participants managed to find the answer after the initial search term failed to find any topics.

Ken tried *space* as his second search term. He retrieved a list of topics and saw Armstrong right away. He stated in the Think Aloud, "I am going to check for names." He clicked on the article outline and one of the first sections is Important Dates in the History of Space Exploration. He quickly located Yuri A. Gagarin and pointed to his name on the screen. In the Think After, Ken talked about scanning through the article outline looking for the words "first person." He also said he was looking for a "man's name" although he also "found the first woman too."

Figure 24: Space Exploration Article in 1999 World Book (Deluxe)


ARTICLE OUTLINE
Flight of Voyager 2
Probes to comets
Halley's Comet
Human beings enter space
Vostok and Mercury: Thefirst human beings in space
Early manned spacecraft
First seven U.S. astronauts
Voskhod and Gemini: The first multiperson space flights
Astronaut Edward H. White II walks in space
Apollo: Mission to the moon
Apollo spacecraft
Making ready
Orbiting the moon
Landing on the moon
Apollo 11
Exploring the moon
First people on the moon
Returning to the earth
Apollo 11 after
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

Space exploration

Ham, who made an 18-minute flight in a Mercury capsule on Jan. 31, 1961.

The first fatality in a manned space program occurred on March 23, 1961. A Soviet cosmonaut trainee named Valentin V. Bondarenko burned to death in a pressure chamber fire. Soviet officials covered up the accident.

The first human being in space was a Soviet air force pilot named Yuri A. Gagarin. He was launched aboard Vostok (later referred to as Vostok 1) on April 12, 1961. In 108 minutes, Gagarin orbited the earth once and returned safely. An autopilot device controlled the spacecraft during the entire flight. A 25-hour, 17-orbit flight by cosmonaut Gherman Titov aboard Vostok 2 followed in August of that year.

The Mercury program made its first manned flight on May 5, 1961, when a Redstone rocket launched astronaut Alan B. Shepard, Jr., in a capsule he named Freedom 7. Shepard flew a 15-minute *suborbital mission*--that is, a mission that did not reach the speed and altitude required to orbit the earth.

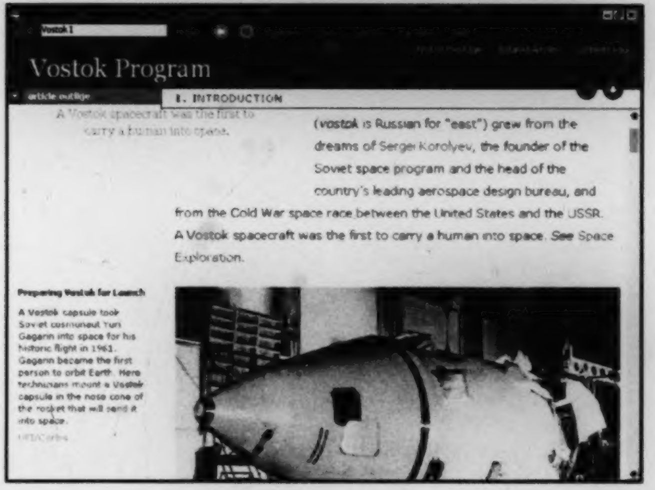
A suborbital flight on July 21, 1961, by astronaut Virgil I. Grissom almost ended tragically. The Mercury capsule's side hatch opened too soon after splashdown

Mary also typed *space* as her second search term. She used the article outline and skimmed down the list until she found Dawn of the Space Age (See Figure 24). She clicked on several sections with names because she "thought it would be the person who was the first one in space." She read three paragraphs of information before finding the answer.

Sue searched Microsoft Encarta Encyclopedia Deluxe 2000 while most of the other participants searched in 1999 World Book (Deluxe) for the *first man in space*. She got a long list of articles and tried several names including Karl Joseph Bobko and Frank Borman. She was clear in the Think Aloud that she was "trying to find out if there's any little clues to find out who the first astronauts in space are." With so many names and on the list of topics she found it "confusing… because for typing in first man in space it came up with all the different astronauts."

It was here that Sue was quite different from other searchers. She found out that the first American orbited the earth in 1962 and that "the first piloted Mercury mission was in May 1961." She then read that "Vostok training started again in 1960 and Vostok was launched in March 1961." Her next search term was *Vostok I* and she immediately located Yuri A. Gagarin in the article (See Figure 25). It was quite frustrating for Sue because there were a lot of names and she had no idea who the first person in space might be. In the Think After, Sue talked about not being "sure what term I would put in so." She did know however, that Buzz Aldren and Neil Armstrong were not the first people in space. Sue said "I knew that there had been other people earlier."

Figure 25: Vostok I Article in Microsoft Encarta Encyclopedia Deluxe 2000



Vostok Program

I. INTRODUCTION

A Vostok spacecraft was the first to carry a human into space.

(vostok is Russian for "east") grew from the dreams of Sergei Korolyev, the founder of the Soviet space program and the head of the country's leading aerospace design bureau, and from the Cold War space race between the United States and the USSR. A Vostok spacecraft was the first to carry a human into space. *See* Space Exploration.

Preparing Vostok for Launch

A Vostok capsule took Soviet cosmonaut Yuri Gagarin into space for his historic flight in 1961. Gagarin became the first person to orbit Earth. Here technicians mount a Vostok capsule in the nose cone of the rocket that will send it into space.

UPI/Corbis

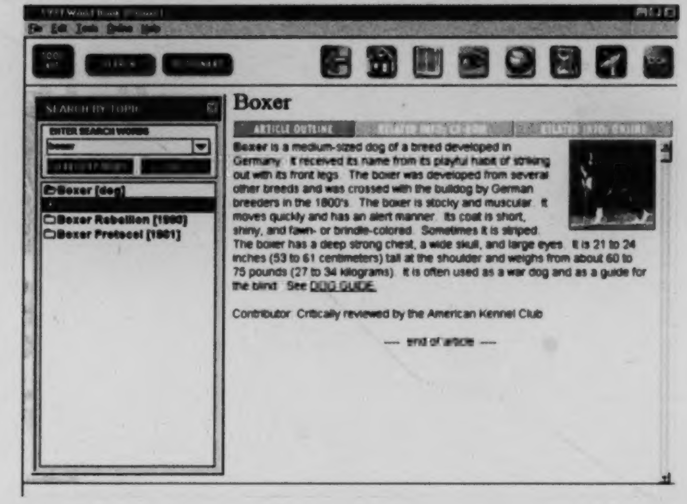
Paul used *astronauts* as his initial search term again to try to find the answer to the question. He clicked on article outline and saw the bubble view and then the section on Important Astronaut and Cosmonaut firsts. He located Yuri A. Gagarin quickly. In the Think After, Paul talked about seeing "first… first American, first important Americans in, first American in space."

Lynn had some difficulties with this search and with her search term, *space, first man*. The inverted search terms had worked well in the first two searches on Microsoft Encarta Encyclopedia Deluxe 2000 but failed to find any topics in 1999 World Book (Deluxe). She was frustrated and said, "that isn't going to work." Lynn typed in *space* as her second search term and the space exploration article came up. She decided to search again and asked "Do you know what year that was in?" She clarified the question again by asking "space or the moon?" Her next search term was *man in space* and this located an article about important dates in radio. She skimmed the article on radio and located the date 1961. She tried several combinations of search terms including *1961 space man*, *1961 space*, and *1961*. She found Yuri A. Gagarin in the article. In the Think After Lynn said she was very frustrated. She admitted that she was going to stop searching when she got to radio. When she did find the date (1961), she "thought that might, there might not be that many important things" and this would help locate the answer.

5.2.8 Information-seeking Processes - Boxer

Most of the participants had very little difficulty finding the answer to this question. The average amount of time in minutes was just over 2 minutes and the range was just under 30 seconds to over 7 minutes. Participants who tried *boxer* or *boxer dog* easily located the article on the list of topics and clicked on the article (See Figure 26). They all read from the article rather than using the picture to answer the question. Even those participants with background knowledge did not use the picture though most clicked on the picture to enlarge it.

Figure 26: Boxer Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
boxer
Boxer [dog]
Boxer Rebellion [1900]
Boxer Protocol [1901]
Boxer
ARTICLE OUTLINE

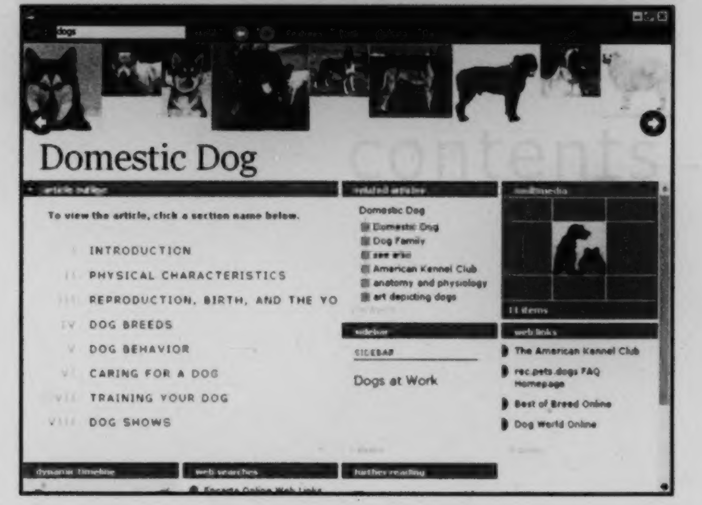
Boxer is a medium-sized dog of a breed developed in Germany. It received its name from its playful habit of striking out with its front legs. The boxer was developed from several other breeds and was crossed with the bulldog by German breeders in the 1800's. The boxer is stocky and muscular. It moves quickly and has an alert manner. Its coat is short, shiny, and fawn- or brindle-colored. Sometimes it is striped. The boxer has a deep strong chest, a wide skull, and large eyes. It is 21 to 24 inches (53 to 61 centimeters) tall at the shoulder and weighs from about 60 to 75 pounds (27 to 34 kilograms). It is often used as a war dog and as a guide for the blind. See DOG GUIDE.

Contributor: Critically reviewed by the American Kennel Club

— end of article —

Fran, who knew what a boxer looked like, decided to use *dogs* as her initial search term. In Microsoft Encarta Encyclopedia Deluxe 2000, the article on dogs has a rolling screen across the top and the user can look at many different dogs (See Figure 27).

Figure 27: Domestic Dogs Article in Microsoft Encarta Encyclopedia Deluxe 2000


dogs
contents
Domestic Dog
article outline
related articles
multimedia
11 items
sidebar
web links
dynamic timeline
web searches
further reading
Encarta Online Web Links

To view the article, click a section name below.

- I INTRODUCTION
- II PHYSICAL CHARACTERISTICS
- III REPRODUCTION, BIRTH, AND THE YO
- IV DOG BREEDS
- V DOG BEHAVIOR
- VI CARING FOR A DOG
- VII TRAINING YOUR DOG
- VIII DOG SHOWS

Domestic Dog
- Domestic Dog
- Dog Family
- see also
- American Kennel Club
- anatomy and physiology
- art depicting dogs

SIDEBAR

Dogs at Work

- The American Kennel Club
- rec.pets.dogs FAQ Homepage
- Best of Breed Online
- Dog World Online

Fran decided to scroll through the pictures until she was able to locate the picture of the boxer. We passed the chow chow, Boston terrier, Bichon Frise, bulldog, "one of those Lassie dogs", and a spaniel. At the golden retriever, Fran related a story,

> I had a golden retriever. We sold it in Edmonton because it got too rough with me 'cause I was too small. I like looking at these dogs. There's one of these kind in town.

The list continued with Doberman, Rottweiler, husky, and "poodle thing" before locating the boxer. Fran said, "See I told you. I knew what it looked like." When asked, in the Think After what she would have done if she hadn't known what a boxer looked like, she replied "I probably would have just skimmed through and looked for the boxer." Figure 27 shows the search screen where Fran located the answer to the question.

5.2.9 Search Session 1 Summary

All twelve participants were able to locate the answers to the four questions in search session one although the amount of time needed to find the answer varied from participant to participant and from question to question. Several of the participants became frustrated. With Fran it took about four minutes while Lynn was discouraged after a couple of search terms that located no topics. Paul did not reach a level of frustration, even after more than twenty minutes, in the first woman in space search because he was interested in the other information he found.

The participants had an overall average time of just over 5 ½ minutes to answer each question in Search Session 1. The participants used a variety of search terms and some spent a long time just staring at the screen. Navigation within the CD-ROM encyclopedias was a frustrating problem during the first searches. The participants struggled with article outlines and list of topics. They had trouble clicking back and several times became lost or ended up back at the initial search page. Some of the participants used huge strings of terms together to try to locate the answer. This worked better in Microsoft Encarta Encyclopedia Deluxe 2000 because it searches for the terms by article while 1999 World Book (Deluxe) searches by sentence in the default mode. Microsoft Encarta Encyclopedia Deluxe 2000 has stop words that it doesn't search for, for example, *who was the first woman in space* becomes *first woman space*. 1999 World Book (Deluxe) does offer the search by word feature that allows users to change the default from sentence to paragraph or article but it would be very difficult for the novice user to understand this and locate this feature.

5.4 Search Session 2 Introduction

In Search Session 2, each participant answered four questions developed in consultation with their Social Studies teacher. These questions provided the researcher with the opportunity to observe a variety of approaches to information seeking. Participants used both Microsoft Encarta Encyclopedia Deluxe 2000 and 1999 World Book (Deluxe) to locate the answers. No formal or informal introduction to the CD-ROM encyclopedia was provided to the participants during the second search session. About one week had passed since the first search session.

5.5 Search Session 2 – Grade 7 Questions

Each of the grade seven participants answered the same four questions during Search Session 2. The questions were developed in consultation with the teacher from the Social Studies curriculum. The grade seven students were working on an Alaska unit at the time of the data collection. The four questions follow:

1. How long is the Alaska pipeline?
2. Who designed the flag of Alaska?
3. What was the population of the capital city of Alaska in 1996?
4. In what year did Alaska have a huge earthquake?

The participants searched for the answers to questions 1 and 2 on 1999 World Book (Deluxe) and questions 3 and 4 on Microsoft Encarta Encyclopedia Deluxe 2000.

The following table provides information about the initial search term used in the search to find the answer to each question.

Table VI: Initial Search Terms used by Grade 7s in Search Session 2

Name	Alaska Pipeline	Alaska Flag	Population of Capital (1996)	Year of Earthquake
Eric	Alaska's pipeline	Alaska's flag	Alaska's population of the capital city	Alaska's earthquake
Paul	Alaska	Flag of Alaska	Capital	Alaska
Fran	Alaska	Alaska designers	Capital of Alaska	Alaska
Carol	Alaska	Alaska	Alaska population	Alaska and earthquake

Table VI shows the amount of time needed by each participant to find the answer to the question in Search Session 2.

Table VII: Time needed by Grade 7s to find Answers in Search Session 2

Name	Alaska Pipeline	Alaska Flag	Population of Capital (1996)	Year of Earthquake
Eric	00:33	01:08	06:07	01:11
Paul	08:08	01:49	06:17	01:52
Fran	02:55	07:30	05:36	01:01
Carol	03:00	02:10	09:06	01:50

The mean time to find the answer to the Alaska pipeline question was just under four minutes with the range being just over 30 seconds to just over 8 minutes. The Alaska flag question had a range of just over a minute to 7 ½ minutes to find the answer. The mean was about 3 ¼ minutes. The most complex question was the third one that required participants to find out the capital city of Alaska and then to find out the population in 1996. The range of times needed to find the answer went from just over 5 ½ minutes to just over 9 minutes with a mean of just under 7 ½ minutes. The Alaska earthquake question was the easiest for participants. They all found the answer in less than two minutes with the mean being 1 ½ minutes.

5.5.1 Information-seeking Processes – Alaska pipeline

Eric was the only participant to type in *Alaska's pipeline* as the initial search term for question one. This search term resulted in the article on Alaska coming up. The section called The Discovery of Oil displayed with the word *pipeline* highlighted in red. Eric found the answer right away. All of the other participants started with the initial search term *Alaska* yet they found the answers in quite different ways.

Paul typed *Alaska* because he had seen pipeline while searching for another answer on a different encyclopedia. He said,

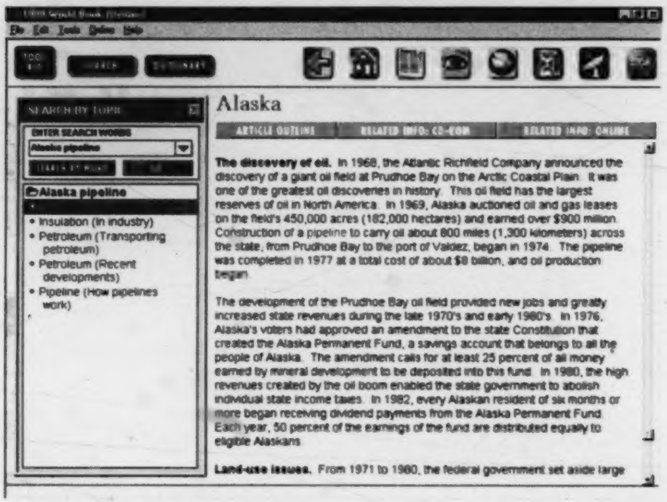
> Alaska. 'Cause when I was going through trying to find Alaska, what was that Alaska, um? We just went to it. I seen Alaska's pipeline so I remembered that. This is a different one [CD-ROM encyclopedia]. I don't know if it is in here, it should be. Nothing. So I am going to go to panhandle.

Paul clicked on the article outline for Alaska and scrolled down the list until found the section on The Discovery of Oil. In his Think Aloud he continued,

> That's about the pipeline. Oh okay. 40 million. Okay the pipeline was completed in 1997… oil production began. I don't think, do you think it is in there?

Paul decided to try another search term, *Alaska pipeline*, which found him the answer "about 800 miles about 1300 kilometres across the state of Prudhoe Bay." Figure 28 shows where both Eric and Paul located the answer to the question.

Figure 28: Alaska Article in 1999 World Book (Deluxe)



Alaska pipeline

- Insulation (in industry)
- Petroleum (Transporting petroleum)
- Petroleum (Recent developments)
- Pipeline (How pipelines work)

Alaska

The discovery of oil. In 1968, the Atlantic Richfield Company announced the discovery of a giant oil field at Prudhoe Bay on the Arctic Coastal Plain. It was one of the greatest oil discoveries in history. This oil field has the largest reserves of oil in North America. In 1969, Alaska auctioned oil and gas leases on the field's 450,000 acres (182,000 hectares) and earned over $900 million. Construction of a pipeline to carry oil about 800 miles (1,300 kilometers) across the state, from Prudhoe Bay to the port of Valdez, began in 1974. The pipeline was completed in 1977 at a total cost of about $8 billion, and oil production began.

The development of the Prudhoe Bay oil field provided new jobs and greatly increased state revenues during the late 1970's and early 1980's. In 1976, Alaska's voters had approved an amendment to the state Constitution that created the Alaska Permanent Fund, a savings account that belongs to all the people of Alaska. The amendment calls for at least 25 percent of all money earned by mineral development to be deposited into this fund. In 1980, the high revenues created by the oil boom enabled the state government to abolish individual state income taxes. In 1982, every Alaskan resident of six months or more began receiving dividend payments from the Alaska Permanent Fund. Each year, 50 percent of the earnings of the fund are distributed equally to eligible Alaskans.

Land-use issues. From 1971 to 1980, the federal government set aside large

Fran also saw Alaska pipeline while doing another search. After being asked the question, Fran stated in her Think Aloud,

> I saw that one. I saw that. Yes. Oh what did I type in? Right here watch. Three mountain ranges… 800 miles, 1300 kilometres.

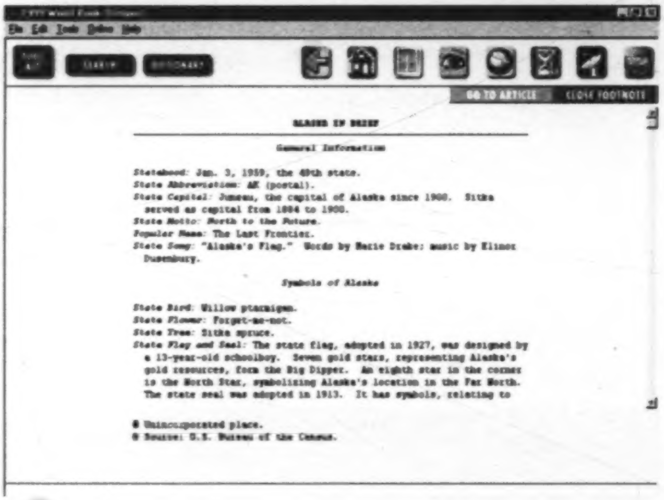
Carol was quite frustrated with the organization of the CD-ROM encyclopedia while trying to find the answer to the question. She went to Alaska and looked at the article outline. She went to Economy and looked through the whole section including natural resources and mining before asking, what about the "oil industry?" She was very surprised not to see oil under Economy. Carol went back to the list of topics under Alaska and spent a long time looking at the section around Alaska Panhandle and Alaska Permanent Fund expecting to see a topic called Alaska pipeline in the alphabetical list.

She accidentally clicked on Alaska Permanent Fund and a folder opened beneath it called The Discovery of Oil. She clicked on the folder and it took her back to the Alaska article and to the answer that she quickly located.

5.5.2 Information-seeking Processes – Alaska Flag

Three of the participants found the answer to the question quite quickly. Eric typed in *Alaska's flag* as his initial search term. An article called Alaska in Brief came up and the answer was easily located here. Paul using the initial search term *flag of Alaska* also located the same article and quickly located the answer. The words *flag* and *Alaska* were highlighted in the article making it easy for both searchers to find the answer. Figure 29 shows where two of the participants located the answer to the question.

Figure 29: Alaska in Brief Article in 1999 World Book (Deluxe)



ALASKA IN BRIEF

General Information

Statehood: Jan. 3, 1959, the 49th state.
State Abbreviation: AK (postal).
State Capital: Juneau, the capital of Alaska since 1900. Sitka served as capital from 1884 to 1900.
State Motto: North to the Future.
Popular Name: The Last Frontier.
State Song: "Alaska's Flag." Words by Marie Drake; music by Elinor Dusenbury.

Symbols of Alaska

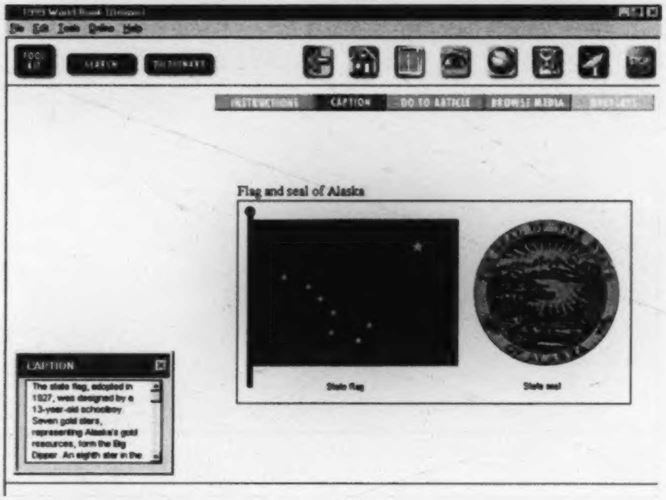
State Bird: Willow ptarmigan.
State Flower: Forget-me-not.
State Tree: Sitka spruce.
State Flag and Seal: The state flag, adopted in 1927, was designed by a 13-year-old schoolboy. Seven gold stars, representing Alaska's gold resources, form the Big Dipper. An eighth star in the corner is the North Star, symbolizing Alaska's location in the Far North. The state seal was adopted in 1913. It has symbols, relating to

● Unincorporated place.
● Source: U.S. Bureau of the Census.

Fran, on the other hand, typed in *Alaska designers* as her initial search term. This resulted in no topics found. The next search term was *flags* and it located a large list of topics. Fran clicked on the article outline and spent some time skimming the list before deciding "I don't want that [article outline] to be there." Her next search term *flag designers* also resulted in no topics found. Frustration set in here and Fran asked, "How long did it take everyone else to find it? Did I already find it? Did I pass it yet?" Fran next tried *Alaskans flags* and then *flags of Alaska* and both resulted in no topics found. Her final search term was *Alaska's flag* that then located the Alaska in Brief article and the answer.

Carol found the article by typing in *Alaska* as her initial search term. She checked the list of topics looking for flag but there was not a topic so she then clicked on the article outline. She found the flag and seal of Alaska in the article outline, clicked on it, and then scanned the section of the article near the picture. Carol then clicked on the picture and read the caption that went with the flag. Figure 30 shows the search screen that Carol used to find the answer.

Figure 30: Alaska Article in 1999 World Book (Deluxe)


1999 World Book (Deluxe)
File Edit Tools Online Help
TOOL KIT
SEARCH
DICTIONARY
INSTRUCTIONS
CAPTION
GO TO ARTICLE
BROWSE MEDIA
Flag and seal of Alaska
State flag
State seal
CAPTION

The state flag, adopted in 1927, was designed by a 13-year-old schoolboy. Seven gold stars, representing Alaska's gold resources, form the Big Dipper. An eighth star in the

5.5.3 Information-seeking Processes – Alaska Capital City

This question was the most complex and difficult in Search Session 2 for participants. Carol began with *Alaska population* as her initial search term. Her Think Aloud reveals that she had enough background knowledge to find the answer quickly,

> I am thinking it is going to be under Alaska population. Population chart. Okay. Alaska. Mm. Okay so Juneau.

Yet, she continued looking at the topics under Alaska population.

> Japan…mmm…education 1991… 1991 okay. 1991 population so. Nope. City growth…1990…1996… 1991 is all it goes up to. Mm. Geography…1191…Okay. Can I search again?

She typed in *Alaska 1996* and then clicked on Alaska. She skimmed the Alaska article and then tried *Alaska 1996 population*. Carol finally decided to try another way to find the answer and typed in Juneau.

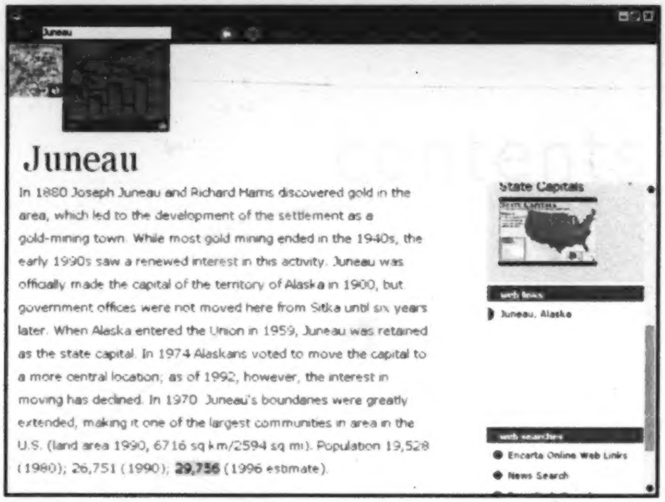
> I think I'll put Juneau. Okay. Alaska. United States. Juneau...1956...1998....1959....1900s....1902....1996 estimate. So the population 18 528, 1980, 29 756.

In the Think After, Carol admitted that she was hung up on *Alaska* and *population*, forgetting the question was about Juneau. She said that while she was scanning through the list of topics and the article outline of Alaska she was looking for numbers. That is apparent in her Think Aloud.

Like Carol, Paul did not know the capital city of Alaska right away. He commented right away, "Wow, what's the capital? We did that last year all year." His first search term was *capital of Alaska*. He scanned the list of topics and quickly saw Juneau. His next search term was *Juneau's population*. He experienced difficulty getting the words typed into the search box. It is quite difficult in Microsoft Encarta Encyclopedia Deluxe 2000 to type in a search term. It immediately starts searching after the first letter is typed. Spelling mistakes and making corrections can take a long time because section of the search term can disappear. This caused great frustration to almost all of the searchers over the course of the study. Eventually Paul was able to complete his search term, click on Juneau and find the answer. He clarified the question once he located the Juneau article, "Oh. Just the population? What year? 1992, 1956. Oh yeah. 1996. 29 756."

Fran also experienced difficulty typing in the correct search term in Microsoft Encarta Encyclopedia Deluxe 2000 on this search. She also tried *Juneau's population* later in her search. Fran spent more than two minutes of the search just trying to get the spelling correct without losing one word or the other. Some frustration was apparent here in the comment "It doesn't show anything on here." The search screen where all the participants located the answer is shown in Figure 31.

Figure 31: Juneau Article in Microsoft Encarta Encyclopedia Deluxe 2000



Juneau

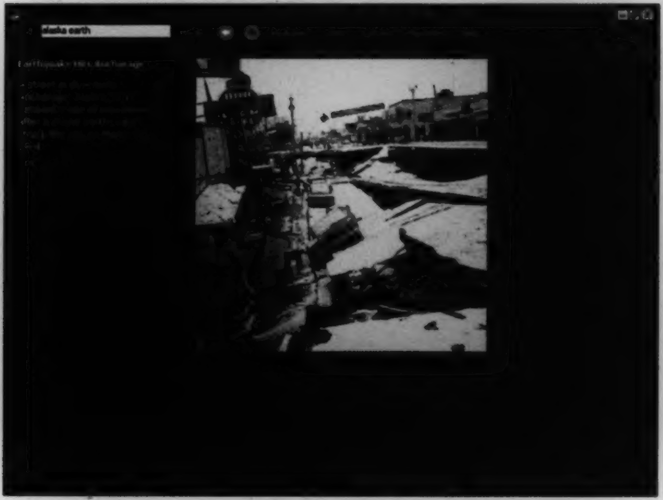
In 1880 Joseph Juneau and Richard Harris discovered gold in the area, which led to the development of the settlement as a gold-mining town. While most gold mining ended in the 1940s, the early 1990s saw a renewed interest in this activity. Juneau was officially made the capital of the territory of Alaska in 1900, but government offices were not moved here from Sitka until six years later. When Alaska entered the Union in 1959, Juneau was retained as the state capital. In 1974 Alaskans voted to move the capital to a more central location; as of 1992, however, the interest in moving has declined. In 1970 Juneau's boundaries were greatly extended, making it one of the largest communities in area in the U.S. (land area 1990, 6716 sq km/2594 sq mi). Population 19,528 (1980); 26,751 (1990); 29,756 (1996 estimate).

Eric also was frustrated with this search. He tried *Alaska's population of the capital city*, *Alaska's capital city*, and *Alaska's capital*. In the Think After, Eric hoped for a chart that would show the population of the cities because "sometimes it's possible that something like that could come up." He was not sure what the capital of Alaska was and said he "won't go right to it if I am not too sure." When I asked him why he sat so long without saying anything he replied, "I was thinking what to type. Alaska's capital, the population of Alaska's capital in 1996." He admitted that he knew the capital city, Juneau, when he saw it come up. While scanning through the Juneau article looking for the answer, Eric was looking for numbers not words. He knew the number would be a "big one" and that when he saw 29 756 it sounded right.

5.5.4 Information-seeking Processes – Alaska Earthquake

The final question was easy to find. The answer was located on the list of topics and the participants did not even need to read an article. Two participants used *Alaska* and *earthquake* in their initial search term and two participants began with *Alaska*. For Eric, *Alaska's earthquake* found the answer on the list of topics. Eric did click on the article and look at the picture of the devastation. For three of his four searches, Eric used *Alaska's* to start the search term, for example, *Alaska's pipeline*, *Alaska's flag*, and *Alaska's earthquake*. In the Think After, Eric stated that using the apostrophe 's' made sense "because it sounds more better than Alaska capital. It makes more sense as a question." Eric kept using the strategy because it worked before and "if it is somewhere I will usually say that first part." Figure 32 shows the picture that the participants exclaimed over when searching for the answer to the question.

Figure 32: Earthquake Hits Anchorage Picture in Microsoft Encarta Encyclopedia Deluxe 2000



Paul typed *Alaska* and looked at the list of topics to locate Alaska earthquake. He clicked on the article and a picture and a caption came up. He exclaimed,

> Holy Cow! Okay, how do you go down [to read the caption]? Alaskan earthquake in 1964 was rated 9.2 on the Richter scale. One of the most powerful earthquakes every known to hit North America. It claimed 131 lives, devastated parts of Anchorage, Valdez. That was pretty big.

When I asked Fran the question, she remembered seeing Alaska earthquake on the list of topics. She burst out, "I seen that. I seen that. March 27, 1964. Holy Cow! Even the road fell off." Carol typed in *Alaska and earthquake* as her initial search term. She stated, "It should be this one. Earthquake Alaska 1964. Wow!" In the Think After for the previous question, Carol and I talked about search terms and I suggested that using *and* sometimes helps when trying to find a topic. In the next question, she immediately used *Alaska and earthquake* to find the answer.

The grade seven participants had an overall average time of just over four minutes to answer each question. They used a variety of initial search terms and spent quite a long time typing in those terms. This was especially a problematic in Microsoft Encarta

Encyclopedia Deluxe 2000 and created some frustration for participants. The 1999 World Book (Deluxe) provides a spell check feature that is helpful. The CD-ROM encyclopedia also does not begin to search until the user clicks *go* or *search by word*. This is a very good feature for novice users as it allows them to choose the term they wish to use and to get the spelling as accurate as possible before they search. 1999 World Book (Deluxe) the presents alternate spellings for the student to select. Microsoft Encarta Encyclopedia Deluxe 2000 does provide this feature after the student stops typing and the search by the CD-ROM encyclopedia is complete.

5.6 Search Session 2 – Grade 8 Questions

Each of the grade eight participants were asked the same four questions during Search Session 2. The questions were developed in consultation with the grade eight teacher from the Social Studies curriculum. The grade seven students were working on an Egypt unit at the time of the data collection. The four questions follow:

1. What is the official language of Egypt?
2. During what years did Ramses II reign?
3. What is the origin of the word pharaoh?
4. Find the flag and national anthem of Egypt.

The participants found the answers to questions 1 and 2 on Microsoft Encarta Encyclopedia Deluxe 2000 and questions 3 and 4 on 1999 World Book (Deluxe). Table VII shows the initial search terms used by the grade eight participants.

Table VIII: Initial Search Terms used by Grade 8s in Search Session 2

Name	Official Language	Ramses II	Pharaoh	Flag and National Anthem
Dave	*Official language of Egypt*	*When was ramses the second pharaoh*	*What the pharaoh meant*	*Flag of Egypt*
Ken	*The official language of Egypt*	*Year that ramses the second reigned*	*Pharaoh*	*Flag and national anthem of Egypt*
Lynn	*Egypt*	*Pharaoh of Egypt*	*Origin of word pharaoh*	*Egypt national anthem*
Abby	*Egypt language*	*Kings of Egypt*	*pharaoh*	*Egypt*

The table presents the initial search terms used by the participants. It is easy to see that Dave and Ken continue to use long strings of words in their initial search term. Lynn and

Abby, however, consistently use fewer terms. The following table presents the time needed to answer each of the four teacher-generated questions.

Table IX: Time needed by Grade 8s to find Answers in Search Session 2

Name	Official Language	Ramses II	Pharaoh	Flag and National Anthem
Dave	13:50	06:38	02:00	10:17
Ken	02:07	03:52	01:08	02:23
Lynn	02:23	02:52	01:29	02:41
Abby	13:25	03:14	04:32	08:28

The mean time to find the answer to the official language of Egypt was just over 8 minutes, with the range being just over 2 minutes to almost 14 minutes. The reign of Ramses II question had a range of just about 2 minutes to 6 ½ minutes. The mean was about 4 ¼ minutes. The third question required the participants to find the origin of the word pharaoh. Participants found the answer in a range of times from just over a minute to about 4 ½ minutes. The mean time to find the answer was just over 2 ¼ minutes. Two participants located the final answer quite easily but the other two participants found it quite difficult. The range was from just under 2 ½ minutes to just over 10 ¼ minutes and the mean was six minutes.

5.6.1 Information-seeking Processes – Official Language of Egypt

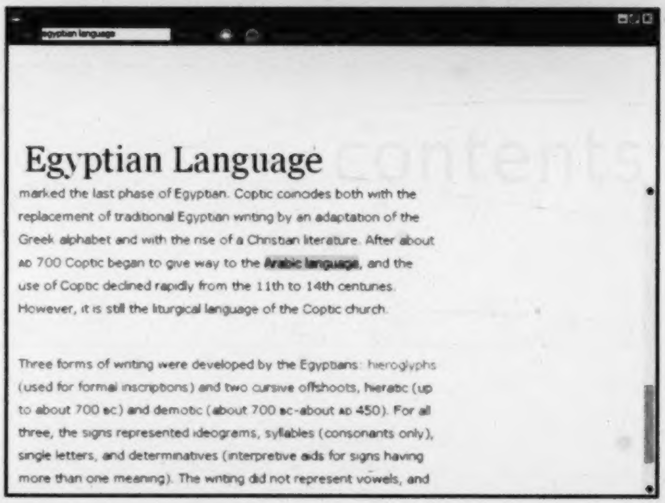
This question was the most difficult for participants and two were unable to find the answer. It is interesting to look at the reason why two of the searchers failed to find answers. Dave's initial search term was *official language of Egypt*. Egypt was the only topic that came up on the list. Dave clicked on Egypt and the section on Language immediately came up; the words *official*, *language*, and *Egypt* highlighted in yellow. Dave did not read the section but scrolled up using the mouse. He read a section on climate and then clicked on the article outline. He read the outline three or four times and stopped at each major heading and all subheadings except for Population.

Dave clicked off the article outline and then back on the article outline and read it through several more times. He carefully followed each subheading with his mouse but could not locate any sections of interest. Dave closed the outline and proceeded to skim the article. In several places, he appeared to stop and read but the sections were never appropriate places to find the answer. After a reasonable length of time, I asked him if he wanted to stop and try a different question. In the Think After, I showed him the answer could be found under Population. Dave stated that he did not look in that section because "I thought it was just the population."

Abby was also unable to locate the answer to the question. Her hesitation was in the Think Aloud from the beginning. She said, "Egyptian's language. This is a hard one. I am thinking what to put in. Egyptian's language. Um. I have no clue." Abby tried *Egyptian's language* and then *Egyptian language*. An article entitled Egyptian language immediately came up on the screen. She read most of the article and followed links to Afro-Asiatic Languages, African Language, Coptic Language and Traditional Music of Nigeria. Abby read quite slowly and carefully and this took a long time. After about fourteen minutes and some heavy sighing on her part, I asked her if she was frustrated. She said, "Yes." and I stopped the search and showed her where to find the answer.

Lynn knew the answer before she began searching. She did not give an indication of this for several minutes. Her initial search term was *Egypt* and she clicked on Egyptian languages from the list of topics. She skimmed through the article and then said, "I think the language is Arabic." She used this article as confirmation of her background knowledge. Figure 33 shows the search screen where she located the information to answer the question.

Figure 33: Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000



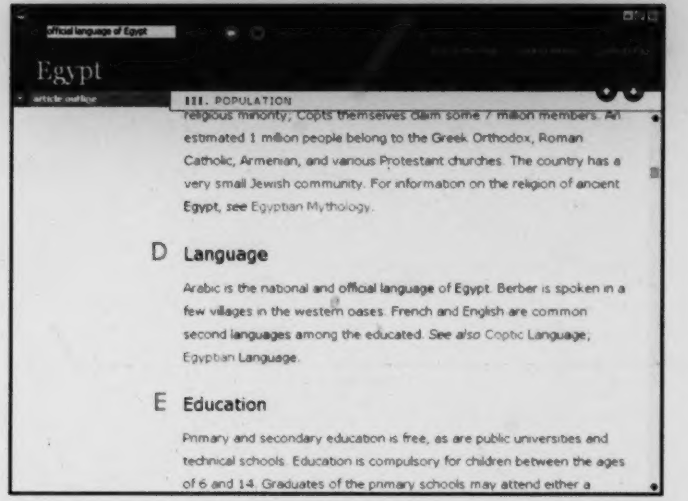
Egyptian Language

marked the last phase of Egyptian. Coptic coincides both with the replacement of traditional Egyptian writing by an adaptation of the Greek alphabet and with the rise of a Christian literature. After about AD 700 Coptic began to give way to the Arabic language, and the use of Coptic declined rapidly from the 11th to 14th centuries. However, it is still the liturgical language of the Coptic church.

Three forms of writing were developed by the Egyptians: hieroglyphs (used for formal inscriptions) and two cursive offshoots, hieratic (up to about 700 BC) and demotic (about 700 BC-about AD 450). For all three, the signs represented ideograms, syllables (consonants only), single letters, and determinatives (interpretive aids for signs having more than one meaning). The writing did not represent vowels, and

Ken was also able to find the official language of Egypt quite quickly. He typed in *official language of Egypt* and arrived at the same spot in the article that Dave did in his search. Ken noticed the highlighted yellow words in the article and scrolled down so that the whole paragraph on language was on the screen. He said in the Think Aloud, "French and English. Is this it? Western? This one? There. (pointed to the word Arabic)." Figure 34 shows the search screen where Ken located the answer to the question.

Figure 34: Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000



religious minority; Copts themselves claim some 7 million members. An estimated 1 million people belong to the Greek Orthodox, Roman Catholic, Armenian, and various Protestant churches. The country has a very small Jewish community. For information on the religion of ancient Egypt, see Egyptian Mythology.

D Language

Arabic is the national and official language of Egypt. Berber is spoken in a few villages in the western oases. French and English are common second languages among the educated. *See also* Coptic Language; Egyptian Language.

E Education

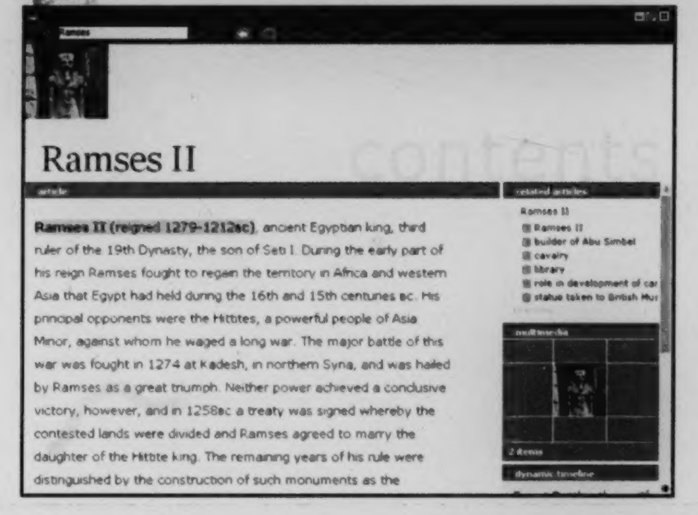
Primary and secondary education is free, as are public universities and technical schools. Education is compulsory for children between the ages of 6 and 14. Graduates of the primary schools may attend either a

It was very interesting to see the four participants locate two different articles and then for one participant to be successful and one unsuccessful at locating the answer in each article.

5.6.2 Information-seeking Processes – Reign of Ramses II

This question was not too difficult for the participants once they managed to spell Ramses II correctly. Several different search terms worked at locating the appropriate article. Dave used a variety of natural language strings to try to find the answer to the question. He tried ***when was ramses the second pharaoh***, ***ramses was the***, ***Ramses the second was king*** and then ***Ramses***. He clicked on Ramses II when the list of spelling options came up and located the answer right away. Both Abby and Lynn also found the answer to the question after several different search terms. Figure 35 shows the search screen where Dave, Abby, and Lynn all found the answer to the question.

Figure 35: Ramses II Article in Microsoft Encarta Encyclopedia Deluxe 2000

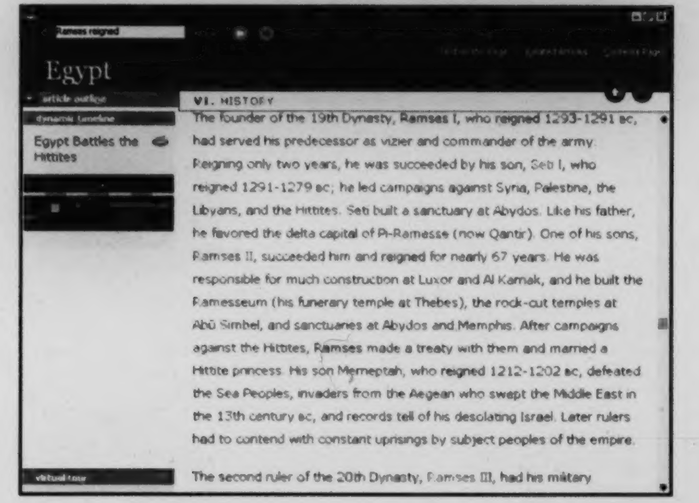

Ramses
contents
article
related articles
Ramses II
Ramses II
builder of Abu Simbel
cavalry
library
role in development of car
statue taken to British Mus
multimedia
2 items
dynamic timeline

Ramses II

Ramses II (reigned 1279-1212BC), ancient Egyptian king, third ruler of the 19th Dynasty, the son of Seti I. During the early part of his reign Ramses fought to regain the territory in Africa and western Asia that Egypt had held during the 16th and 15th centuries BC. His principal opponents were the Hittites, a powerful people of Asia Minor, against whom he waged a long war. The major battle of this war was fought in 1274 at Kadesh, in northern Syria, and was hailed by Ramses as a great triumph. Neither power achieved a conclusive victory, however, and in 1258BC a treaty was signed whereby the contested lands were divided and Ramses agreed to marry the daughter of the Hittite king. The remaining years of his rule were distinguished by the construction of such monuments as the

Ken managed to locate the answer to the question in different place than the rest of the participants. He typed in ***Ramses the second reigned*** and clicked on the Egypt article. Ken used his math skills in the Think Aloud when he said, "right there. Sixty-seven years. 1279 to 12… Subtract 1212 from 1279. 67 years. Mm hm." Figure 36 shows the search screen where Ken located the answer.

Figure 36: Egypt Article in Microsoft Encarta Encyclopedia Deluxe 2000


Ramses reigned
Egypt
article outline
dynamic timeline
Egypt Battles the Hittites
virtual tour

VI. HISTORY

The founder of the 19th Dynasty, Ramses I, who reigned 1293-1291 BC, had served his predecessor as vizier and commander of the army. Reigning only two years, he was succeeded by his son, Seti I, who reigned 1291-1279 BC; he led campaigns against Syria, Palestine, the Libyans, and the Hittites. Seti built a sanctuary at Abydos. Like his father, he favored the delta capital of Pi-Ramesse (now Qantir). One of his sons, Ramses II, succeeded him and reigned for nearly 67 years. He was responsible for much construction at Luxor and Al Karnak, and he built the Ramesseum (his funerary temple at Thebes), the rock-cut temples at Abū Simbel, and sanctuaries at Abydos and Memphis. After campaigns against the Hittites, Ramses made a treaty with them and married a Hittite princess. His son Merneptah, who reigned 1212-1202 BC, defeated the Sea Peoples, invaders from the Aegean who swept the Middle East in the 13th century BC, and records tell of his desolating Israel. Later rulers had to contend with constant uprisings by subject peoples of the empire.

The second ruler of the 20th Dynasty, Ramses III, had his military

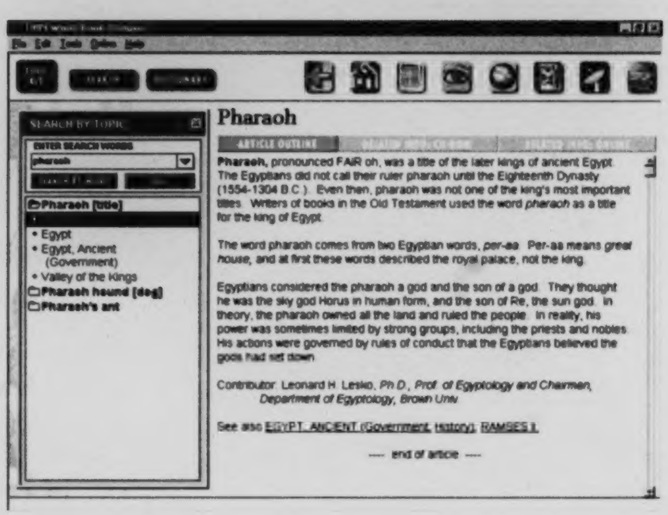
5.6.3 Information-seeking Processes – Origin of the Word Pharaoh

Locating the answer to this question was quite easy for most of the participants. Lynn used *origin of the word Pharaoh* as her initial search term. Her Think Aloud provided some interesting information about her search.

> Pharaoh, okay. Is that? I think so. Otherwise it's "ao". Word origin. Origin. Um. Pharaoh. Origin. No matches found. Okay. Search word. Okay. Um. Origin of Pharaoh. Okay, um. Let's see. Pharaoh. There we go. I just found something. Okay, maybe I spelled it wrong. Egypt… The word pharaoh comes from two Egyptian words per – aa means great house and was first used to describe the Royal Palace.

Abby already had the Egypt list of topics on the screen and then clicked on search to type in *pharaoh*. She read the first paragraph in the article silently and then said, "It came from two Egyptian words. I can't pronounce them. Means great house." Ken's search was exactly the same as Abby's. In his Think After, Ken stated that he typed in pharaoh because he "was thinking of something to put down that would be good so I could find it." Figure 37 shows the search screen where the participants located the answer to the question.

Figure 37: Pharaoh Article in 1999 World Book (Deluxe)



Pharaoh

Pharaoh, pronounced FAIR oh, was a title of the later kings of ancient Egypt. The Egyptians did not call their ruler pharaoh until the Eighteenth Dynasty (1554-1304 B.C.). Even then, pharaoh was not one of the king's most important titles. Writers of books in the Old Testament used the word *pharaoh* as a title for the king of Egypt.

The word pharaoh comes from two Egyptian words, *per-aa*. Per-aa means *great house*, and at first these words described the royal palace, not the king.

Egyptians considered the pharaoh a god and the son of a god. They thought he was the sky god Horus in human form, and the son of Re, the sun god. In theory, the pharaoh owned all the land and ruled the people. In reality, his power was sometimes limited by strong groups, including the priests and nobles. His actions were governed by rules of conduct that the Egyptians believed the gods had set down.

Contributor: Leonard H. Lesko, *Ph.D., Prof. of Egyptology and Chairman, Department of Egyptology, Brown Univ.*

See also EGYPT, ANCIENT (Government, History); RAMSES II.

— end of article —

Dave used the initial search term *what did pharaoh meant* and then *pharaoh*. He used his background knowledge to try to answer the question. He stated, "It was title for kings of Ancient Egypt. They used it for title for kings of Egypt." He read the paragraph and found the answer. In the Think Aloud, I asked him about his initial search term and then his second search term. Dave and I had a discussion in one of the Think Alouds about 1999 World Book (Deluxe) being harder to search with a long string of words. He told me he tried *pharaoh* after *what did pharaoh meant* because he remembered our discussion. He also said that if he were to go to the school library to use the print encyclopedias he would go to volume P.

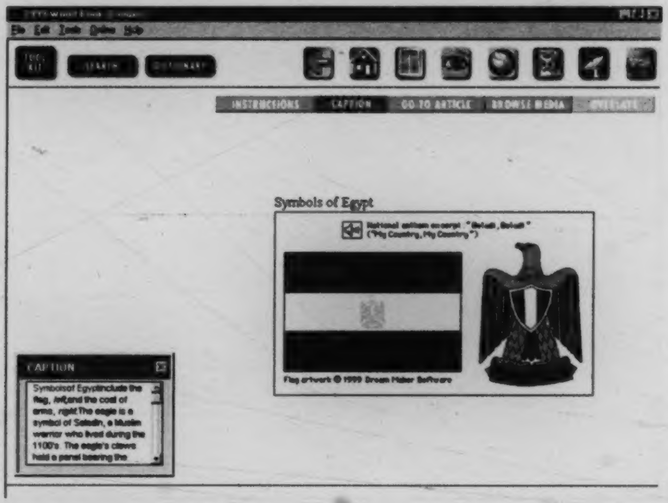
5.6.4 Information-seeking Processes – Flag and National Anthem of Egypt

Ken and Lynn located the answer to the question quite quickly but Abby and Dave had more difficulty. Ken tried *flag and national anthem of Egypt* but got no topics. He then tried search by word and a list of topics came up. He located Symbols of Egypt on the list and clicked on it. The flag and seal came up on the screen immediately and there was an icon on the screen to click so that the National Anthem would play. Lynn had some trouble initially with typing and spelling in Microsoft Encarta Encyclopedia Deluxe 2000 but eventually got to the Egypt article and clicked on the article outline. She scanned through the list but there are no topics about flag or national anthem. She then clicked off the article outline and skimmed through the article until she found the flag and clicked on it. The picture of the flag and seal enlarged and Lynn played the anthem.

Abby began by using *Egypt* as her initial search term. She read the list of topics and the article outline looking for flag without success. Her second search term was *Egypt flag* and the flag article came up immediately. This was not what Abby had hoped for so she tried *Egypt* and *flag* in the search by word function. In the list of topics, Abby found Symbols of Egypt and clicked on the article. The flag and seal and the national anthem came up immediately. Figure 38 shows the search screen where the participants found the answer to the question.

Dave began by typing in *flag of Egypt* and then went to *Egypt*. He clicked on the article outline. He scanned the list looking for the word flag or national anthem. He looked through the article and went right past the flag. In the Think Afters, he said he saw the flag but thought "it was a symbol or something". After a few minutes of searching through the Egypt article, he said "I just got an idea in my head." He typed in *flags and national anthem*. This search term gave him the Olympic Games. With my help, he tried search by word using *flag*, *anthem*, and *Egypt*. In the list of topics, he clicked on Symbols of Egypt. Initially, he was not sure that it was the flag and even clicked back to the list of topics. After several seconds though, he clicked back to the flag and played the national anthem.

Figure 38: Egypt Article in 1999 World Book (Deluxe)



File Edit Tools Online Help
SEARCH
DICTIONARY
INSTRUCTIONS
CAPTION
GO TO ARTICLE
BROWSE MEDIA
Symbols of Egypt
National anthem excerpt: "Biladi, Biladi" ("My Country, My Country")
Flag artwork © 1999 Dream Maker Software
CAPTION

Symbolsof Egyptinclude the flag, left,and the coat of arms, right.The eagle is a symbol of Saladin, a Muslim warrior who lived during the 1100's. The eagle's claws hold a panel bearing the

Search Session 2 ended up being quite frustrating for several of the participants. Dave and Abby seemed to have the most difficulty with the searches. They took longer on most searches that Lynn and Ken and were unable to find the answer to the first question on the official language of Egypt. Both were inexperienced searchers and poor readers so skimming seemed to take longer for them. They also had more difficulty generating alternative search terms than Lynn, in particular.

5.7 Search Session 2 – Grade 9 Questions

Each of the grade nine participants answered the same four questions during Search Session 2. The questions were developed in consultation with the grade nine teacher from the Social Studies curriculum. At the time of the data collection, the grade nine students were working on Canadian geography, specifically inland waterways. The four questions follow:

1. What is the lift of the Welland Canal?
2. Name a country through which the equator passes.
3. Into what body of water does the Nelson River flow?
4. Name a country through which the Tropic of Cancer passes.

The participants did not do the questions in the same order but did search for the answers on the same CD-ROM encyclopedia, that is, questions 1 and 2 on Microsoft Encarta Encyclopedia Deluxe 2000 and questions 3 and 4 on 1999 World Book (Deluxe).

The following table provides information about the initial search term used in the search to find the answer to each question.

Table X: Initial Search Terms used by Grade 9s in Search Session 2

Name	Welland Canal	Equator	Nelson River	Tropic of Cancer
Chris	*Welland*	*Countries of Africa*	*Rivers, Nelson*	*Tropic of Cancer*
Bob	*Welland Canal*	*Equator*	*Nelson River*	*Tropic of Cancer*
Mary	*Welland Canal*	*Equator*	*Nelson River*	*Tropic of Cancer*
Sue	*Welland Canal lift*	*Country along the equator*	*Nelson River*	*Country in the Tropic of Cancer*

The table shows the amount of time needed by the participants to find the answer to the question in Search Session 2.

Table XI: Time needed by Grade 9s to find Answers in Search Session 2

Name	Welland Canal	Equator	Nelson River	Tropic of Cancer
Chris	01:22	21:31	03:55	00:43
Bob	01:46	05:00	00:42	01:20
Mary	02:35	12:15	01:12	01:38
Sue	05:31	00:56	00:47	01:32

The mean time to find the answer to the Welland Canal question was almost 3 minutes with the range being just under 1 ½ minutes to just over 5 ½ minutes. The second question had a huge range from just under 1 minute to over 21 ½ minutes. The mean was just under 10 minutes. The third question required participants to find out into which body of water the Nelson River flows. The range of times needed to find the answer went from 42 seconds to just under 4 minutes with a mean of just over 1 ½ minutes. The final question was the easiest for participants. They all found the answer in less than two minutes with the mean being just over 1 ¼ minutes.

5.7.1 Information-seeking Processes – Welland Canal

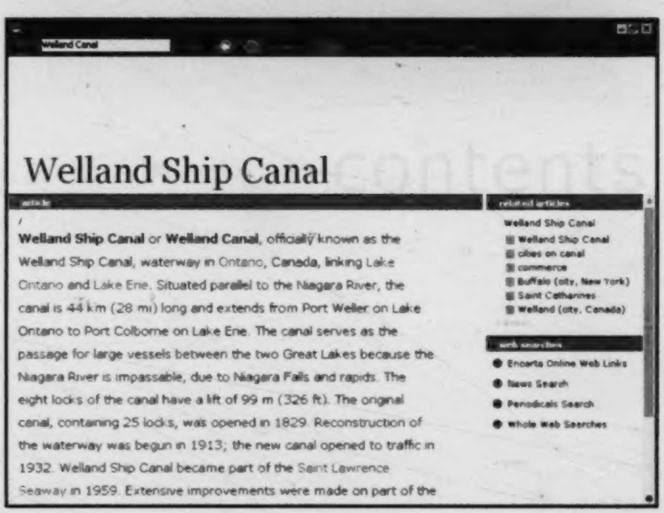
Sue was the only participant who had any trouble at all with this question. She encountered problems immediately with Microsoft Encarta Encyclopedia Deluxe 2000 and trying to type in *Welland Canal lift*. She found Welland, the city, right away and skimmed the article. On the list of topics there was also Welland Ship Canal but she did not click on it. She tried several other search terms such as *Welland Canal (lift)* and then *Welland Canal*. She clicked on the article and skimmed through it but missed the answer. At this point, she was quite frustrated because "the words Welland Canal and lift do not appear anywhere together." Sue tried *Welland Canal lift* next, but found no topics. She clicked back onto the Welland Ship Canal article, read it again, and located the answer.

The rest of the participants found the answer quickly using search terms *Welland* or *Welland Canal*. Bob thought he knew the answer. He stated,

> There's like 16 locks for the… 175 feet… Six go 75 feet. But the rest of them go… Yeah. Oh. I wonder if this is the one I am thinking of. All of the locks.

He had a few problems with Microsoft Encarta Encyclopedia Deluxe 2000 getting the correct search term in before it gave him a list of topics. Bob said in his Think After that he knew where the Welland Canal was and what it did so he was able to locate the information quickly. Figure 39 shows the search screen where the participants found the answer.

Figure 39: Welland Canal Article in Microsoft Encarta Encyclopedia Deluxe 2000



Welland Canal
contents
article
related articles
Welland Ship Canal
Welland Ship Canal
cities on canal
commerce
Buffalo (city, New York)
Saint Catharines
Welland (city, Canada)
web searches
Encarta Online Web Links
News Search
Periodicals Search
Whole Web Searches

Welland Ship Canal

Welland Ship Canal or **Welland Canal**, officially known as the Welland Ship Canal, waterway in Ontario, Canada, linking Lake Ontario and Lake Erie. Situated parallel to the Niagara River, the canal is 44 km (28 mi) long and extends from Port Weller on Lake Ontario to Port Colborne on Lake Erie. The canal serves as the passage for large vessels between the two Great Lakes because the Niagara River is impassable, due to Niagara Falls and rapids. The eight locks of the canal have a lift of 99 m (326 ft). The original canal, containing 25 locks, was opened in 1829. Reconstruction of the waterway was begun in 1913; the new canal opened to traffic in 1932. Welland Ship Canal became part of the Saint Lawrence Seaway in 1959. Extensive improvements were made on part of the

5.7.2 Information-seeking Processes – Country on the Equator

This was the most difficult question of Search Session 2 for most participants. Chris had the most difficulty but his search was very interesting. Chris knew exactly where the equator was and that it went through Africa. What he did not know was the name of any of the countries in Africa. In his Think Aloud, Chris talked about his background knowledge and also his frustration with the CD-ROM encyclopedia.

> I think it goes through Africa. Oh, okay. Countries. That is how you spell countries, right? Okay. Countries of Africa. Oh. Um. Change that. It should show a picture of the world right. World picture. Where was that thing? Maybe its through Africa not Africa though. (clicked on countries of Africa) (Africa came up). (clicking on map of Africa) Number 44, how can I look at that. Oh right. Africa. (mumbling) Can I put African? Maybe… A-F-R-I-C… (typed in African countries) (big list) Oops… Oh… How can I get a picture of the world? (mumbling)(went to map) (clicked on map) (skimming article outline) (looking at types of maps across the top of the screen) This won't tell me what's the… That might. (clicked on projection map – countries not labeled and equator not labeled) There is a place that is on the equator but I don't remember where it is. (clicked back to map) (clicked on topographic map) Oh no, same thing. (clicked back) (clicked on types of maps) Oh, I have an idea. I'm not sure if that'll work. (clicked back to countries of Africa map) How can I see what these countries are? I need a country. I have to go up more. (looking at map) Is it Asia?

At this point in the search, Chris knew that there is a country in Africa through which the equator passes but he could not get there in any reasonable way. He located a map of Africa but it was divided into sections such as Western Africa and Northern Africa. He asked, "Are these countries?" Chris found the country Tunisia and tried that as a search term. He found a map of Tunisia and said, "Ah, there we go. That is better, much much better. I got to go down but how?" Then he continued, "Is it Namibia? Sahara? Algeria?" With the map, Chris was able to see a list of places arranged alphabetically. I told him that "those are just different names of places and it takes you to the map." He replied, "Hmmm. That is exactly the way I want to do." Chris stated,

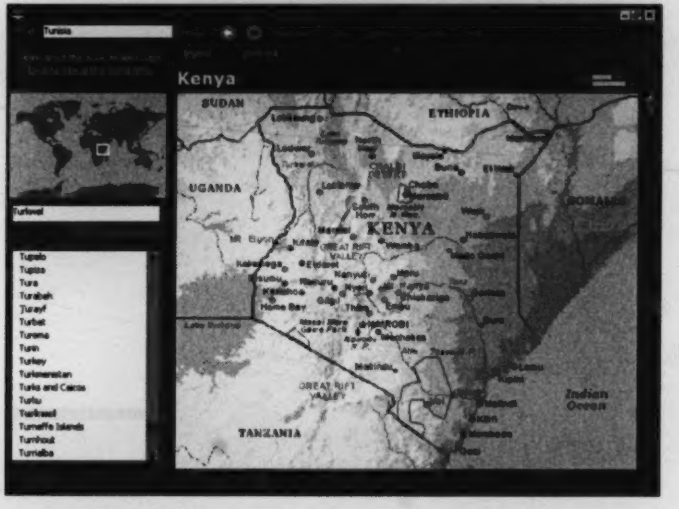
> That's Africa. Okay. I don't know any African countries. Africa countries. I don't know any countries in Africa. That's why I was trying different ones in order to uh. How do I spell that? (typed Tunisia)

Using the map, Chris began to scroll down the list of places beginning with 'T'. His Think Aloud tracked the progress,

> That is on the other side. (Taiwan) Tupelo, Mississippi. Turin, Turkmenistan, Turks…Oh, that looks pretty low. Is it Kenya?

Figure 40 shows the search screen where Chris found the Kenyan city.

Figure 40: Interactive World Map in Microsoft Encarta Encyclopedia Deluxe 2000

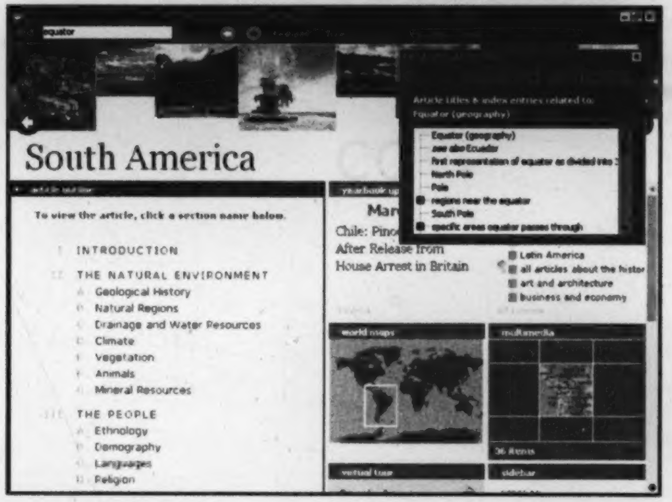

Tunisia
Kenya
Turkwel
Tupelo
Tura
Turayf
Turin
Turkey
Turkmenistan
Turks and Caicos
Turku
Turneffe Islands
Turnhout
SUDAN
ETHIOPIA
UGANDA
KENYA
GREAT RIFT VALLEY
NAIROBI
TANZANIA
Indian Ocean

Unbelievably, he found a city in Kenya using this method. He realized that Kenya was in about the right spot for the equator to pass through. Chris typed in Kenya into the search box and got a list of topics. He read the introduction to the article on Kenya and found out that the equator passes through the country. In the Think Afters, Chris commented that he learned a lot during the search. He said that he tried the initial search term *countries in Africa* because the CD-ROM encyclopedia "might show some of them." He said he had never studied Africa and did not know one country there to start. I asked him why he did not type in equator at some point and he replied, "I might have but I was still thinking about geography." Chris did not seem to become frustrated at all throughout the long search but at the end of the Think After he said next time he would use an atlas to find the answer.

Bob and Mary both typed *equator* as their initial search term. Bob said, in his Think Aloud, "I am looking for geography because it will tell where it will go." He read the article on the equator but did not find the name of a country. Bob made his way into a related article on South America but did not find the answer. He tried *equator passes* and then *country equator passes* as search terms. Each came up with a list of topics. On the list were several countries including Ecuador, Brazil, and Kenya. He pointed to Kenya as an answer. In the Think After, Bob stated, "I do not know why I did not think Ecuador was on the equator."

Mary spent much of her search time looking at the list of topics generated by the search term *equator*. It was a very difficult question because she did not know the difference between a continent and a country. This was true of Chris as well. She tried Central Africa, Ethiopia and Australia from the list of topics. Mary went back to the article on equator and clicked on the related articles section and found a topic on Cayambe, Ecuador. She said she used the highlighted words to help her find the answers. Sue used the initial search term *country along the equator* and then tried *country (equator)*. This generated a list of topics. Reading the list of articles, she asked, "Um Congo, Democratic Republic of the? Ecuador?" In the Think After, Sue stated, "if you just put equator it might just tell what the equator is and so maybe I specified country that's on the equator." Figure 41 shows the search screen that Bob and Mary found using the related articles feature.

Figure 41: South America Article in Microsoft Encarta Encyclopedia Deluxe 2000


equator
Article titles & index entries related to:
Equator (geography)
Equator (geography)
see also Ecuador
first representation of equator as divided into 3
North Pole
Pole
regions near the equator
South Pole
specific areas equator passes through
South America
To view the article, click a section name below.
I INTRODUCTION
II THE NATURAL ENVIRONMENT
A Geological History
B Natural Regions
C Drainage and Water Resources
D Climate
E Vegetation
F Animals
G Mineral Resources
III THE PEOPLE
A Ethnology
B Demography
C Languages
D Religion
Chile: Pino
After Release from
House Arrest in Britain
Latin America
all articles about the histor
art and architecture
business and economy
world maps
multimedia
36 items
virtual tour
sidebar

This question was difficult only because the participants seemed to have such limited background knowledge about the topic. They were unsure of countries, continents and geography in general. Even knowing that the equator went through Africa, proved to be little help for Chris.

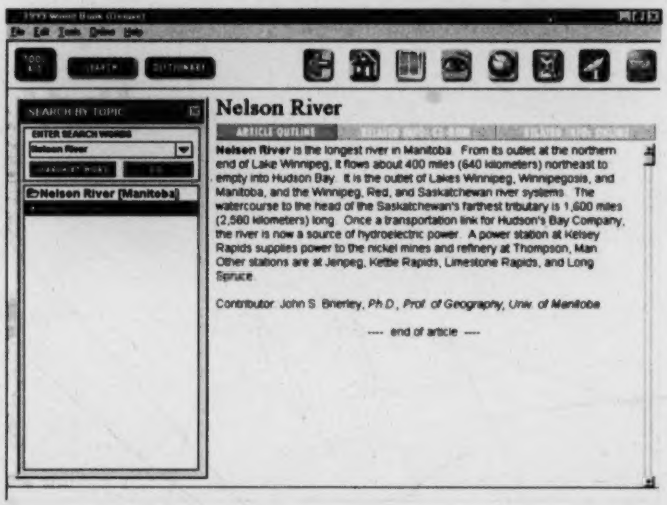
5.7.3 Information-seeking Processes – Nelson River

The participants found the answer to this question quite easily. Bob, Mary and Sue all typed *Nelson River* as the initial search term, located the article, and read the first paragraph of the article to find the answer. Chris typed in *rivers, Nelson* and found no topics. His Think Aloud was interesting,

> What was that river called again? Nelson River. Is it in Canada? So rivers wouldn't do. Maybe river. How big is the river? What is this?

Eventually he typed Nelson River and read out the answer "it flows into Hudson Bay." In the Think After, Chris stated, "Well I thought since it's different I would try river, Nelson like in a dictionary but then I tried Nelson River and I got it." Figure 42 shows the search screen where the participants found the answer.

Figure 42: Nelson River Article in 1999 World Book (Deluxe)



Nelson River

Nelson River is the longest river in Manitoba From its outlet at the northern end of Lake Winnipeg, it flows about 400 miles (640 kilometers) northeast to empty into Hudson Bay It is the outlet of Lakes Winnipeg, Winnipegosis, and Manitoba, and the Winnipeg, Red, and Saskatchewan river systems The watercourse to the head of the Saskatchewan's farthest tributary is 1,600 miles (2,580 kilometers) long Once a transportation link for Hudson's Bay Company, the river is now a source of hydroelectric power. A power station at Kelsey Rapids supplies power to the nickel mines and refinery at Thompson, Man Other stations are at Jenpeg, Kettle Rapids, Limestone Rapids, and Long Spruce

Contributor John S Brierley, *Ph D , Prof of Geography, Univ of Manitoba*

---- end of article ----

5.7.4 Information-seeking Processes – Country on the Tropic of Cancer

All of the students found the answer to this question quickly. Chris, Bob and Mary all typed *Tropic of Cancer* as their initial search term. Bob stated that he knew that the Tropic of Cancer was "north". In his Think After, Bob stated that he "skimmed the first paragraph. It was like telling where it is." Mary, on the other hand, "read the whole thing" to find the answer. Chris said, in his Think Aloud,

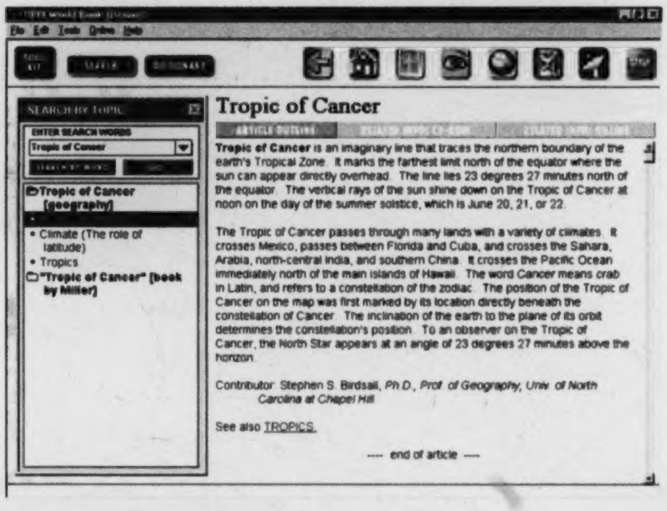
> I am typing in Tropic of Cancer because it might give me more information about what is on the Tropic of Cancer than Encarta. Countries. North of the equator. Okay. Is Mexico a country?

Sue tried *country on the Tropic of Cancer* and located no topics. She tried *Tropic of Cancer* as her next search term and in her Think Aloud said,

> Okay, it says here it passes through many lands with a variety of climates. It crosses Mexico, passes between Florida and Cuba, and crosses the Sahara, the Arabian peninsula, North Central India and Southern China.

Figure 43 shows the search screen where the participants found the answer to the question.

Figure 43: Tropic of Cancer Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
Tropic of Cancer
Tropic of Cancer [geography]
• Climate (The role of latitude)
• Tropics
"Tropic of Cancer" [book by Miller]
ARTICLE OUTLINE

Tropic of Cancer

Tropic of Cancer is an imaginary line that traces the northern boundary of the earth's Tropical Zone. It marks the farthest limit north of the equator where the sun can appear directly overhead. The line lies 23 degrees 27 minutes north of the equator. The vertical rays of the sun shine down on the Tropic of Cancer at noon on the day of the summer solstice, which is June 20, 21, or 22.

The Tropic of Cancer passes through many lands with a variety of climates. It crosses Mexico, passes between Florida and Cuba, and crosses the Sahara, Arabia, north-central India, and southern China. It crosses the Pacific Ocean immediately north of the main islands of Hawaii. The word Cancer means *crab* in Latin, and refers to a constellation of the zodiac. The position of the Tropic of Cancer on the map was first marked by its location directly beneath the constellation of Cancer. The inclination of the earth to the plane of its orbit determines the constellation's position. To an observer on the Tropic of Cancer, the North Star appears at an angle of 23 degrees 27 minutes above the horizon.

Contributor: Stephen S. Birdsall, *Ph.D., Prof. of Geography, Univ. of North Carolina at Chapel Hill*

See also TROPICS.

---- end of article ----

5.8 Search Session 2 Summary

Participants discovered that simple search terms were the most effective way of finding the answers to the questions during Search Session 2. It also became apparent that background knowledge can help when searching for questions about countries, rivers and geography. The participants moved through the encyclopedias purposefully and spent very little time sitting and thinking about search terms. For the most part, they just jumped right in and were willing to make adjustments to search terms as needed. They spent an average of just over four minutes for all the questions in Search Session 2.

5.9 Search Session 3

Search Session 3 took place about 7 to 10 days after the second search session. After Search Session 2, participants received a note asking them to bring four questions to the next meeting. These questions could be about any topic in which the participant was interested. The three participants who forgot to bring questions to the session spent the first few minutes generating their own questions. Presented in a table for each participant are the questions asked by each participant, the amount of time needed to find the answer or to stop the search, and the initial search terms.

5.9.1 Eric

"I am going to write down my question."

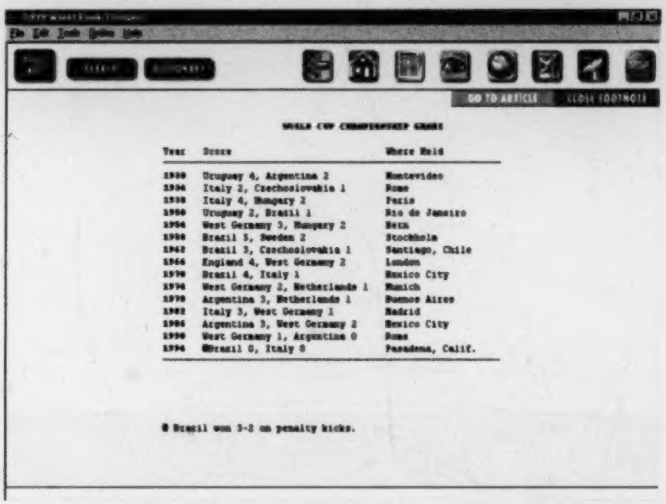
Eric brought four questions to Search Session 3. In the preliminary interview, Eric talked about his love of soccer so the first question is not surprising. Eric and his teacher, Mr. C., developed the second question. Eric stated, "Me and Mr. C. were thinking of trying to get a really hard question." The final questions come from the culture of the school and community.

Table XII: Eric's Search Session 3

Question	Time	Initial Search Term
Who was in the first World Cup Final?	02:56	*the first world cup*
What is the northerly limit of the snake?	02:25	*What is the most northerly limit of the snake*
When was Pokemon invented?	00:28	*Pokemon*
Who won the first Stanley Cup?	03:51	*Who won the first Stanley Cup*

Eric stated that he chose the first question because "I love soccer and I like the World Cup." Eric used *the first world cup* as his initial search term and located an article on soccer. Highlighted in the soccer article were the words *first world cup*. He clicked on article outline and skimmed through the list of sections within the article. He located a chart that listed all of the world cup winners until 1994. Eric spent quite a long time reading the following chart in Table 44.

Figure 44: World Cup Championship Games from 1999 World Book (Deluxe)



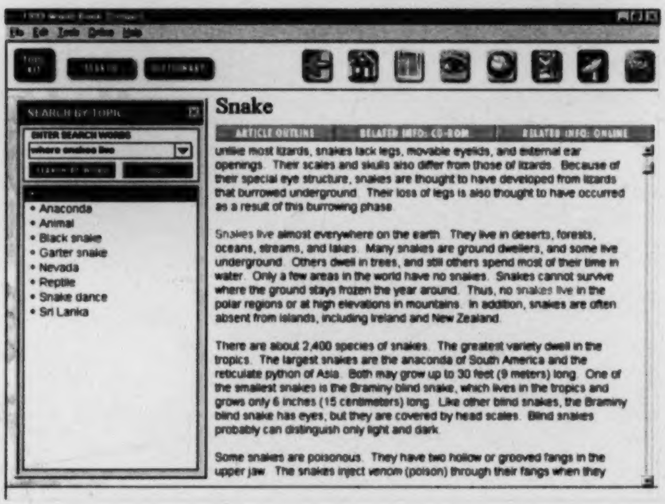
WORLD CUP CHAMPIONSHIP GAMES

Year	Score	Where Held
1930	Uruguay 4, Argentina 2	Montevideo
1934	Italy 2, Czechoslovakia 1	Rome
1938	Italy 4, Hungary 2	Paris
1950	Uruguay 2, Brazil 1	Rio de Janeiro
1954	West Germany 3, Hungary 2	Bern
1958	Brazil 5, Sweden 2	Stockholm
1962	Brazil 3, Czechoslovakia 1	Santiago, Chile
1966	England 4, West Germany 2	London
1970	Brazil 4, Italy 1	Mexico City
1974	West Germany 2, Netherlands 1	Munich
1978	Argentina 3, Netherlands 1	Buenos Aires
1982	Italy 3, West Germany 1	Madrid
1986	Argentina 3, West Germany 2	Mexico City
1990	West Germany 1, Argentina 0	Rome
1994	●Brazil 0, Italy 0	Pasadena, Calif.

● Brazil won 3-2 on penalty kicks.

For Eric's second question, he used *what is the most northernly snake* as his initial search term. Next, he tried the search term *where do snakes live*; the snake article came up right away. He was easily able to locate the answer because of the highlighted words. Table 45 shows the search screen for the snake question. The third question, Pokemon, was not located in either CD-ROM encyclopedia.

Figure 45: Snake Article in 1999 World Book (Deluxe)



Snake

unlike most lizards, snakes lack legs, movable eyelids, and external ear openings. Their scales and skulls also differ from those of lizards. Because of their special eye structure, snakes are thought to have developed from lizards that burrowed underground. Their loss of legs is also thought to have occurred as a result of this burrowing phase.

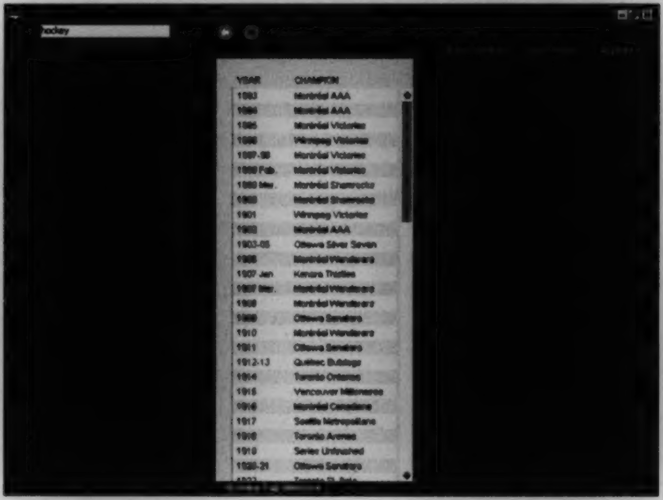
Snakes live almost everywhere on the earth. They live in deserts, forests, oceans, streams, and lakes. Many snakes are ground dwellers, and some live underground. Others dwell in trees, and still others spend most of their time in water. Only a few areas in the world have no snakes. Snakes cannot survive where the ground stays frozen the year around. Thus, no snakes live in the polar regions or at high elevations in mountains. In addition, snakes are often absent from islands, including Ireland and New Zealand.

There are about 2,400 species of snakes. The greatest variety dwell in the tropics. The largest snakes are the anaconda of South America and the reticulate python of Asia. Both may grow up to 30 feet (9 meters) long. One of the smallest snakes is the Braminy blind snake, which lives in the tropics and grows only 6 inches (15 centimeters) long. Like other blind snakes, the Braminy blind snake has eyes, but they are covered by head scales. Blind snakes probably can distinguish only light and dark.

Some snakes are poisonous. They have two hollow or grooved fangs in the upper jaw. The snakes inject venom (poison) through their fangs when they

The fourth question, who won the first Stanley Cup, resulted in a list of topics. In his Think Aloud Eric stated, "That none of these will work, probably. I don't know because… These three teams weren't in hockey back when it started." Eric had enough background knowledge to know that Colorado Avalanche, Calgary Flames, Los Angeles Kings, Ken Dryden and Mark Messier would not be the correct place to locate the answer. He then tried the search term *Stanley Cup* and clicked on Stanley Cup in the list. He commented, "Somebody said they won the first Stanley Cup in the junior." He went to the article on hockey and found a picture of the Stanley Cup. He scrolled down the list until he located Stanley Cup Winners and clicked on the table. The search screen Eric used to locate the answer can be seen in Figure 46.

Figure 46: Stanley Cup Winners from Microsoft Encarta Encyclopedia Deluxe 2000



Eric found the answers in an average of about 2 ½ minutes. Eric tended to use the natural language question as the initial search term for all his self-generated searches. This was very different from his previous searches where he always used a word or phrase, for example, woman in space, cardinal, Alaska's flag, and Alaska's pipeline. In his Think Aloud for the snake question, he commented, "what question to put in." In the second search session, he stated "I was thinking what to type." Eric gave no indication why he changed his search strategy for the last search session.

5.9.2 Paul

"I was looking at some of the stuff because I was interested."

Paul's questions were not as clearly defined as most of the rest of the participants. For question one, he wanted to know "any kinds of sports that's put in." Paul was interested in Atlantis because "they are always making movies on it." For the movie question, he was interested in "any kind of movie, probably horror or scary." The final question, Paul wondered, "Should I check movies? See if there is anything on monsters." The initial search terms and the amount of time for each question is in the table below.

Table XIII: Paul's Search Session 3

Question	Time	Initial Search Term
Sports they put in the Olympics	10:05	*Olimpics*
Atlantis	02:50	*Atlantis*
Movies	07:17	*Film*
Monster Films	12:04	*Monster films*

Paul was more interested in just looking around the encyclopedia than finding a specific answer to most of his "questions". In his Think Aloud, Paul said,

> So I just put Olympics. Is that how you spell it? (types in Olimpics) Okay. (no topics found) (fixing spelling) Backspace Y. Okay (Olympics Games game up) Olympics Games. Atlanta Olympic Games Timelines. Site of Olympic Games…Okay. (clicked on Sites of Olympic Games) Athens, Greece, Paris, St. Louis, London, Stockholm, Brussels, Paris, Amsterdam, Los Angeles. London, Helsinki…Garmish-Partenkircken…St. Moritz, Oslo, Cortina, Squaw Valley, Rome, Tokyo and Innsbruck. Mexico and Grenoble. Sapporo, Montreal, Innsbruck., Los Angeles. Yugoslavia. Oh yeah. Canada. Barcelona Spain, Albertville, and Atlanta. Yeah. Year 2000 Sydney, Australia. Salt Lake City. Okay, let's go to. Back. (Clicked back) (mumbling) Article Outline. Over one billion people watched the Olympic Games on television. Including us. The Olympic Games at Ancient Games… were held from 776 BC to 393 AD. The Olympic Games consists of the summer… 1992. The Olympics held every four years except in 1916 during WWI and 1940 and 1944 during WWII… The winter games… in 1924… winter and summer games divided… scheduled… I'll just go back and check. (looking down article outline) The Summer games? 270 separate events. Holy, that's lots. (Mumbling)

> Summer games have grown enormously… about 311 male athletes representing 13 nations… more than 10 000 male and female athletes representing over 190 nations. The Ancient Games… religious festivals… organized… funeral ceremonies… Combination of boxing, wrestling and kicking. Some unusual… race of armour… chariot race…

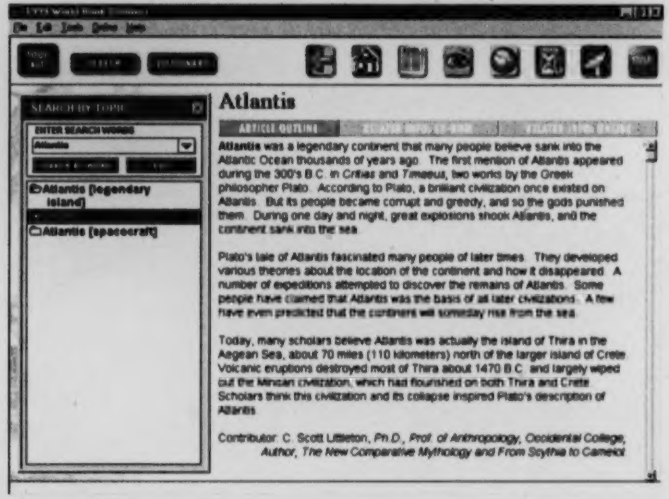
Paul never really did find the answer to his question but seemed to enjoy reading and looking at the information in the encyclopedia.

Paul's second question was about Atlantis. In his Think Aloud, he brought together his background knowledge as he worked his way through the article. He said,

> Yeah. They are always making movies on it. (typed in Atlantis) Atlantis. Atlantis is a lengendary continent…Atlantic Ocean… years ago… The first mention… Greek philosopher Plato? According to Plato… existed in Atlantis. But its people… during one day… continent sank into the sea… Fascinated… various theories… They found Atlantis right? They found…Bermuda Triangle. Remains… basis of all civilization… So that's it? So that's done.

Figure 47 shows the Atlantis search screen that Paul spent time exploring.

Figure 47: Atlantis Article in 1999 World Book (Deluxe)



Atlantis

Atlantis was a legendary continent that many people believe sank into the Atlantic Ocean thousands of years ago. The first mention of Atlantis appeared during the 300's B.C. in *Critias* and *Timaeus*, two works by the Greek philosopher Plato. According to Plato, a brilliant civilization once existed on Atlantis. But its people became corrupt and greedy, and so the gods punished them. During one day and night, great explosions shook Atlantis, and the continent sank into the sea.

Plato's tale of Atlantis fascinated many people of later times. They developed various theories about the location of the continent and how it disappeared. A number of expeditions attempted to discover the remains of Atlantis. Some people have claimed that Atlantis was the basis of all later civilizations. A few have even predicted that the continent will someday rise from the sea.

Today, many scholars believe Atlantis was actually the island of Thira in the Aegean Sea, about 70 miles (110 kilometers) north of the larger island of Crete. Volcanic eruptions destroyed most of Thira about 1470 B.C. and largely wiped out the Minoan civilization, which had flourished on both Thira and Crete. Scholars think this civilization and its collapse inspired Plato's description of Atlantis.

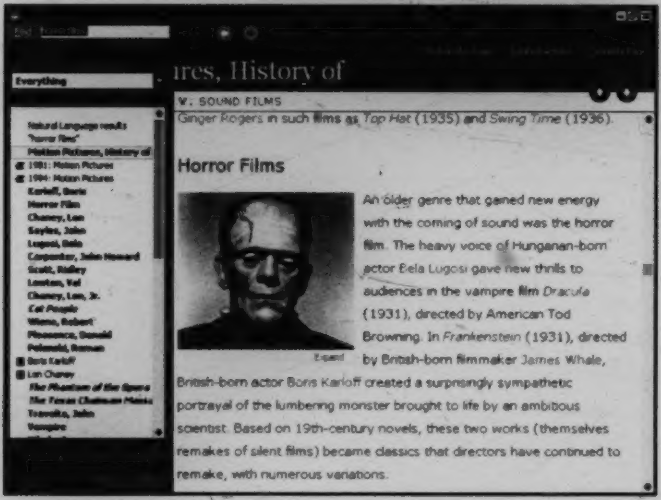
Contributor: C. Scott Littleton, *Ph.D., Prof. of Anthropology, Occidental College,* *Author, The New Comparative Mythology and From Scythia to Camelot*

The third search was much like the first two. He did not really want an answer to the question and was completely satisfied just reading and looking at the pictures. Paul's Think Aloud for this question was also very interesting.

> Movie. Mm any kind of movie, probably horror or scary. Okay. Find. (typed in horror) Oh Cool. Amityville Horror, Horror Film. Rocky Horror Picture Show (clicked on Horror Film) (read description) …frighten audience… actors Bela Lugosi, Lon Chaney, Boris Karloff, history of horror films see history of motion pictures (clicked on history of motion pictures) (reading article) visual medium… covers the medium history… (Boris Karloff) 1931 Frankenstein… horror films… (reading article) audiences …Dracula… James Whale… I want to go to today's horror films. Oh, okay. Let's see. Did you watch the Blair Witch? Kinda. Strange. Or Jason? I want to go to… Let's see. Okay. (types in night and then looks) Night. How do you spell mare? How do you spell? Nightmare. On Elm Street. Nightmare on … (clicked on that) Wes Craven's new nightmare… premiered at Toronto International Film Festival I like that movie. Nightmare on Elm Street. Okay. Mary Shelley's Frankenstein… Kenneth Branagh… Shelley's…

Figure 48 shows one of the search screens that Paul explored.

Figure 48: History of Motion Pictures Article in Microsoft Encarta Encyclopedia Deluxe 2000


ires, History of
Everything
Natural Language results
"horror films"
Motion Pictures, History of
1981: Motion Pictures
1994: Motion Pictures
Karloff, Boris
Horror Film
Chaney, Lon
Sayles, John
Lugosi, Bela
Carpenter, John Howard
Scott, Ridley
Lawton, Val
Chaney, Lon, Jr.
Cat People
Wiene, Robert
Pleasence, Donald
Polanski, Roman
Boris Karloff
Lon Chaney
The Phantom of the Opera
The Texas Chainsaw Massacre
Travolta, John
Vampire
Expand

V. SOUND FILMS

Ginger Rogers in such films as *Top Hat* (1935) and *Swing Time* (1936).

Horror Films

An older genre that gained new energy with the coming of sound was the horror film. The heavy voice of Hungarian-born actor Bela Lugosi gave new thrills to audiences in the vampire film *Dracula* (1931), directed by American Tod Browning. In *Frankenstein* (1931), directed by British-born filmmaker James Whale, British-born actor Boris Karloff created a surprisingly sympathetic portrayal of the lumbering monster brought to life by an ambitious scientist. Based on 19th-century novels, these two works (themselves remakes of silent films) became classics that directors have continued to remake, with numerous variations.

The Think Alouds for all four questions were a combination of previous knowledge, questions to the researcher, and reading of the articles he found while searching. Paul was never frustrated during any of the three search sessions. He commented, when I asked him whether he was frustrated trying to find the answer to the first woman in space question, "I was looking at some of the stuff because I was interested." This comment defined Paul as a searcher. He spent an average of 8 minutes on each search.

5.9.3 Fran

"What did I do to find the other one?"

Fran came to Search Session 3 well prepared to search for answers to her questions. She selected questions that were similar to the researcher-generated and teacher-generated questions used in the first two search sessions. Presented in the table below are the questions, the times needed to find the answer, and the initial search terms.

Table XIV: Fran's Search Session 3

Question	Time	Initial Search Term
Who invented the Canadian flag?	09:50	*Canada*
What is the most populated country in the world	05:37	*Countries*
What is the most populated city in the world	04:20	*Most populated city in the world*
What is the second most populated country in the world?	05:02	*Most populated countries*

Fran used the same initial search term, *flag designers*, that she used when trying to find the answer to the Alaska flag question in Search Session 2. Neither time was this successful. She had some confusion with the term "adoption of the flag" and was looking for a phrase similar to "a thirteen year old boy designed the flag of Alaska." Her Think Aloud was interesting. Fran said,

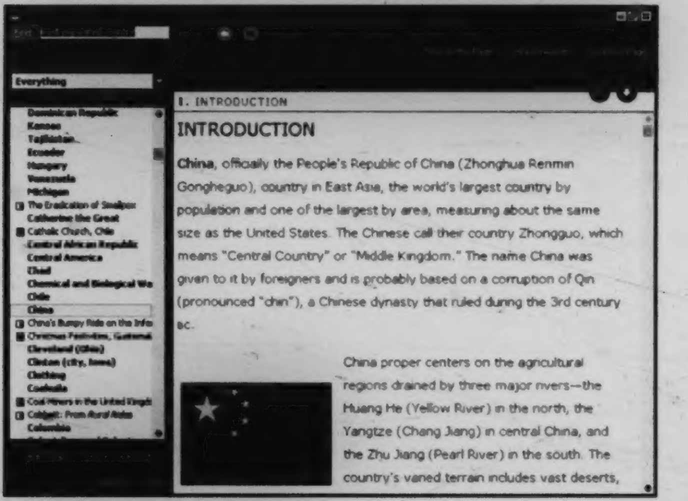
> (typed in Canada) Mm hm. (looking at article outline) (clicked back) (typed in flags) Would this symbol help me? (looking at list of articles) (found nothing) (typed in flag designers) What would work better? (clicked on 1964: Canada) (missed section on Great Canadian Flag Debate) (moving up in article) That's it? (moving down article) Oh. Canadian and French ancestry. No, that's no it. (moving up article) Flag. I want to go there. (looking at section) They adopted it. Are they all

government? Diefenbaker. Right there. It's going to far. Oh, it was Pearson.

Fran asked more questions than the other participants did. She wanted Think Alouds to be more like a conversation.

Fran's next three searches were quite difficult for her. Choosing the correct search term was difficult. For the most populated country question, Fran tried *countries*, *country population*, *most populated country*, and *most populated country in the world* before finding a suitable list of topics. She quickly realized China was the correct answer and clicked on the article for verification. Highlighted words helped locate the answer. Figure 49 illustrates the highlighted words and the search screen Fran used to locate the answer.

Figure 49: China Article from Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Dominican Republic
Kansas
Tajikistan
Ecuador
Hungary
Venezuela
Michigan
The Eradication of Smallpox
Catherine the Great
Catholic Church, Chile
Central African Republic
Central America
Chad
Chemical and Biological We
Chile
China
China's Bumpy Ride on the Info
Christmas Festivities, Guatemal
Cleveland (Ohio)
Clinton (city, Iowa)
Clothing
Cambodia
Coal Miners in the United Kingd
Colgate: From Rural Aisles
Colombia
I. INTRODUCTION

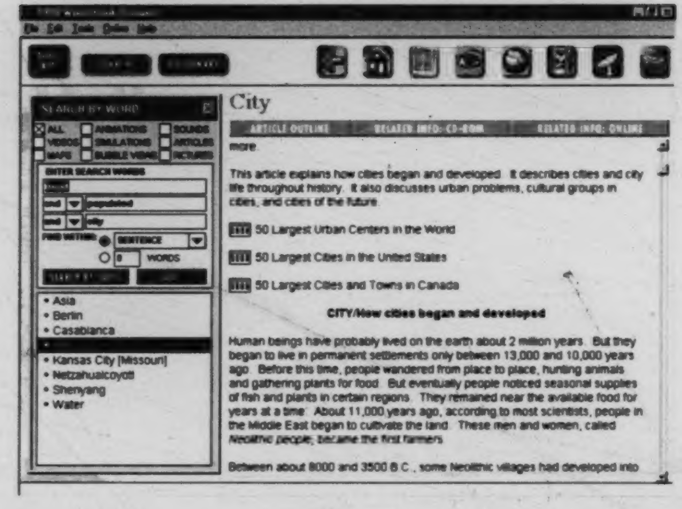
INTRODUCTION

China, officially the People's Republic of China (Zhonghua Renmin Gongheguo), country in East Asia, the world's largest country by population and one of the largest by area, measuring about the same size as the United States. The Chinese call their country Zhongguo, which means "Central Country" or "Middle Kingdom." The name China was given to it by foreigners and is probably based on a corruption of Qin (pronounced "chin"), a Chinese dynasty that ruled during the 3rd century BC.

China proper centers on the agricultural regions drained by three major rivers—the Huang He (Yellow River) in the north, the Yangtze (Chang Jiang) in central China, and the Zhu Jiang (Pearl River) in the south. The country's varied terrain includes vast deserts,

Fran tried *city populations*, *most populated city in the world*, and *most populated city* to find the answer to her third question. None of these search terms located any topics. The final search term, *most* and *populated* and *city*, was entered into the search by word function and located several articles including an article on city. Fran scrolled down the article and located three charts where she knew she could find the answer. Figure 50 shows her search and the location of the answer.

Figure 50: City Article from 1999 World Book (Deluxe)


SEARCH BY WORD
☒ ALL
☐ ANIMATIONS
☐ SOUNDS
☐ VIDEOS
☐ SIMULATIONS
☐ ARTICLES
☐ MAPS
☐ BUBBLE VIEWS
☐ PICTURES
ENTER SEARCH WORDS
FIND WITHIN:
WORDS
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

and populated

and city

● SENTENCE

○ 8 WORDS

- Asia
- Berlin
- Casablanca
- Kansas City [Missouri]
- Netzahualcoyotl
- Shenyang
- Water

City

more

This article explains how cities began and developed. It describes cities and city life throughout history. It also discusses urban problems, cultural groups in cities, and cities of the future.

50 Largest Urban Centers in the World

50 Largest Cities in the United States

50 Largest Cities and Towns in Canada

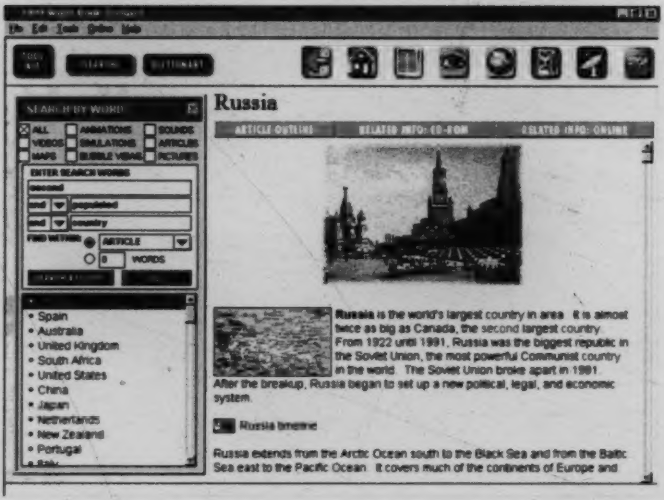
CITY/How cities began and developed

Human beings have probably lived on the earth about 2 million years. But they began to live in permanent settlements only between 13,000 and 10,000 years ago. Before this time, people wandered from place to place, hunting animals and gathering plants for food. But eventually people noticed seasonal supplies of fish and plants in certain regions. They remained near the available food for years at a time. About 11,000 years ago, according to most scientists, people in the Middle East began to cultivate the land. These men and women, called *Neolithic people*, became the first farmers.

Between about 8000 and 3500 B.C., some Neolithic villages had developed into

Her final search was also difficult. Using the search by word function again, Fran typed in *most populated countries* but located no topics. She then tried *populated country world* before *second populated country* located a list of countries. Russia came up and she read the highlighted words before realizing that Russia was not the answer. Figure 51 shows the Russia article.

Figure 51: Russia Article in 1999 World Book (Deluxe)


SEARCH
DICTIONARY
SEARCH BY WORD
☒ ALL
☐ ANIMATIONS
☐ SOUNDS
☐ VIDEOS
☐ SIMULATIONS
☐ ARTICLES
☐ MAPS
☐ BUBBLE VIEWS
☐ PICTURES
ENTER SEARCH WORDS
FIND WITHIN:
WORDS
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

second

and populated

and country

● ARTICLE

○ 8 WORDS

- Spain
- Australia
- United Kingdom
- South Africa
- United States
- China
- Japan
- Netherlands
- New Zealand
- Portugal

Russia

Russia is the world's largest country in area. It is almost twice as big as Canada, the second largest country. From 1922 until 1991, Russia was the biggest republic in the Soviet Union, the most powerful Communist country in the world. The Soviet Union broke apart in 1991. After the breakup, Russia began to set up a new political, legal, and economic system.

Russia timeline

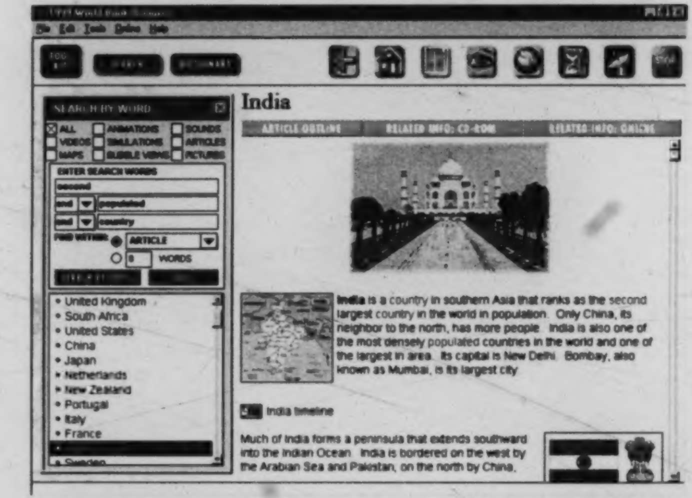
Russia extends from the Arctic Ocean south to the Black Sea and from the Baltic Sea east to the Pacific Ocean. It covers much of the continents of Europe and

Fran had very little background knowledge about this topic and her Think Aloud reflected her confusion.

> Second populated country. What was the first one? Russia? It is almost as big as Canada, the second largest country. Canada. Oh. The article outline. Japan. Well how can we find out? New Zealand? France? Is it in here? Sweden? India? India is the second largest country in the world by population. Ha ha.

Figure 52 shows the search screen where Fran found the answer to her question.

Figure 52: India Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY WORD
☒ ALL
☐ ANIMATIONS
☐ SOUNDS
☐ VIDEOS
☐ SIMULATIONS
☐ ARTICLES
☐ MAPS
☐ BUBBLE VIEWS
☐ PICTURES
ENTER SEARCH WORDS
FIND WITHIN:
● ARTICLE
○ WORDS
India
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE
India timeline

second
and populated
and country

- United Kingdom
- South Africa
- United States
- China
- Japan
- Netherlands
- New Zealand
- Portugal
- Italy
- France
- Sweden

India is a country in southern Asia that ranks as the second largest country in the world in population. Only China, its neighbor to the north, has more people. India is also one of the most densely populated countries in the world and one of the largest in area. Its capital is New Delhi. Bombay, also known as Mumbai, is its largest city.

Much of India forms a peninsula that extends southward into the Indian Ocean. India is bordered on the west by the Arabian Sea and Pakistan, on the north by China,

Fran was the most easily frustrated of all searchers. She required support at all times to use the CD-ROM encyclopedias. She wanted to find the answers right away and asked a lot of questions of herself and of the researcher during the three search sessions. In her first Think After in Search Session 1, Fran stated she expected to find things quickly "because I am good at finding stuff in encyclopedias." She discovered that searching CD-ROM encyclopedias was more difficult than she had imagined. Fran spent an average of just over 6 minutes per search.

5.9.4 Carol

"There's lots."

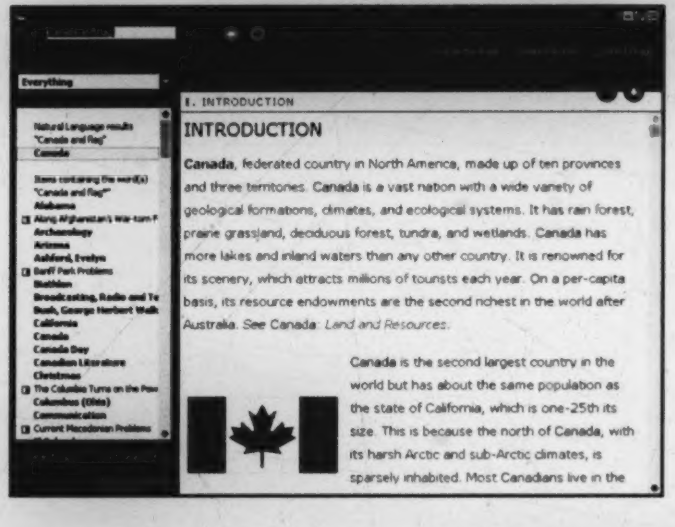
Carol had four carefully prepared questions to ask when she arrived for the final search session. Her questions were framed in a similar way to the research-generated and self-generated questions. Some of the questions were quite difficult. The Canada flag question required searching on both CD-ROM encyclopedias to locate and confirm the answer. The question about music was difficult simply because there is no straightforward answer to that question. The World War I question was answered very quickly. She was interested in that question because "there's lots of TV shows about it and they never tell when it was." The witches and black cats question was not really a question so it was more difficult for Carol to find out exactly what she wanted. The table below shows the questions, the time needed to find the answer, and the initial search terms.

Table XV: Carol's Search Session 3

Question	Time	Initial Search Term
Who made up the Canadian flag?	13:50	*Canada and flag*
Who made up music?	09:39	*Music*
When was World War I?	00:48	*World War I*
Witches and black cats	06:14	*Witches and black cats*

Carol used simple initial search terms to locate articles in the CD-ROM encyclopedias. She remembered our discussion from the previous search session and used *and* in her first search. She located the flag and clicked on it. There was no information with the flag, only a picture and a sound clip of the national anthem. She changed her search term to *Canada flag* and located a shorter list of topics. She tried Lester B. Pearson but didn't find any information about him. Figure 53, below, shows one of the search screens where Carol was unable to locate the information needed to answer the question. Carol found the answer to the question on 1999 World Book (Deluxe) using *Canada and flag* as her search term. She clicked on the history of Canada article and found the answer. Figure 54 shows the search screen where she located the answer.

Figure 53: Canada article from Microsoft Encarta Encyclopedia Deluxe 2000

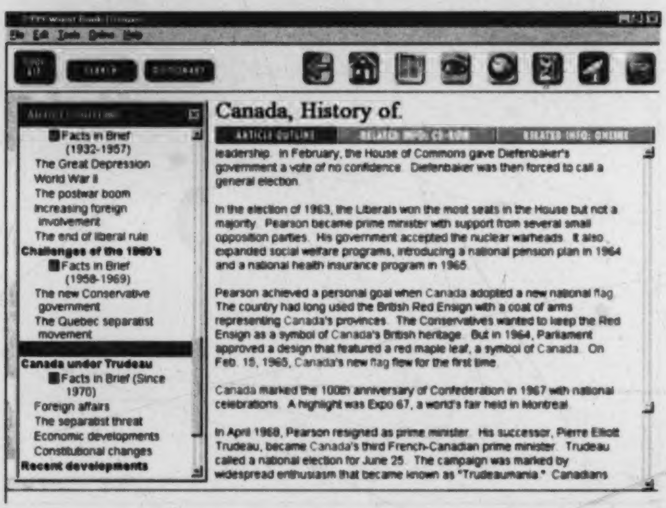

Everything
Natural Language results
"Canada and flag"
Canada
Items containing the word(s)
"Canada and flag"
Alabama
Along Afghanistan's War-torn F
Archaeology
Arizona
Ashford, Evelyn
Banff Park Problems
Biathlon
Broadcasting, Radio and Te
Bush, George Herbert Walk
California
Canada
Canada Day
Canadian Literature
Christmas
The Columbia Turns on the Pow
Columbus (Ohio)
Communication
Current Macedonian Problems
I. INTRODUCTION

INTRODUCTION

Canada, federated country in North America, made up of ten provinces and three territories. **Canada** is a vast nation with a wide variety of geological formations, climates, and ecological systems. It has rain forest, prairie grassland, deciduous forest, tundra, and wetlands. **Canada** has more lakes and inland waters than any other country. It is renowned for its scenery, which attracts millions of tourists each year. On a per-capita basis, its resource endowments are the second richest in the world after Australia. *See* Canada: *Land and Resources.*

Canada is the second largest country in the world but has about the same population as the state of California, which is one-25th its size. This is because the north of Canada, with its harsh Arctic and sub-Arctic climates, is sparsely inhabited. Most Canadians live in the

Figure 54: History of Canada article in 1999 World Book (Deluxe)


File Edit Tools Online Help
Facts in Brief
(1932-1957)
The Great Depression
World War II
The postwar boom
Increasing foreign involvement
The end of liberal rule
Challenges of the 1960's
Facts in Brief
(1958-1969)
The new Conservative government
The Quebec separatist movement
Canada under Trudeau
Facts in Brief (Since 1970)
Foreign affairs
The separatist threat
Economic developments
Constitutional changes
Recent developments
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

Canada, History of.

leadership. In February, the House of Commons gave Diefenbaker's government a vote of no confidence. Diefenbaker was then forced to call a general election.

In the election of 1963, the Liberals won the most seats in the House but not a majority. Pearson became prime minister with support from several small opposition parties. His government accepted the nuclear warheads. It also expanded social welfare programs, introducing a national pension plan in 1964 and a national health insurance program in 1965.

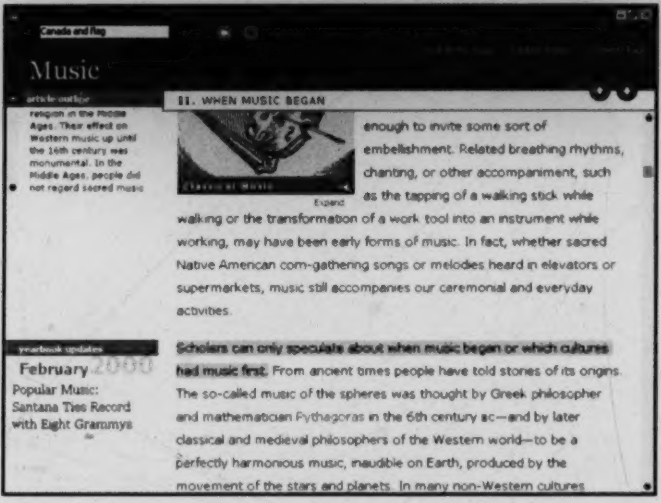
Pearson achieved a personal goal when Canada adopted a new national flag. The country had long used the British Red Ensign with a coat of arms representing Canada's provinces. The Conservatives wanted to keep the Red Ensign as a symbol of Canada's British heritage. But in 1964, Parliament approved a design that featured a red maple leaf, a symbol of Canada. On Feb. 15, 1965, Canada's new flag flew for the first time.

Canada marked the 100th anniversary of Confederation in 1967 with national celebrations. A highlight was Expo 67, a world's fair held in Montreal.

In April 1968, Pearson resigned as prime minister. His successor, Pierre Elliott Trudeau, became Canada's third French-Canadian prime minister. Trudeau called a national election for June 25. The campaign was marked by widespread enthusiasm that became known as "Trudeaumania." Canadians

Carol had difficulty when trying to find out who made up music. The article on music was long so she tried several other search terms in hopes of locating an exact article. She tried natural language search terms such as *who made up music* and *how music got started* before trying *history of music*. The answer came in a section called "when music began". Figure 55 shows the search screen where Carol located the answer.

Figure 55: Music Article in Microsoft Encarta Encyclopedia Deluxe 2000


Canada and Flag
Music
article outline
II. WHEN MUSIC BEGAN
Classical Music
Expand
yearbook updates
February 2000
Popular Music:
Santana Ties Record
with Eight Grammys

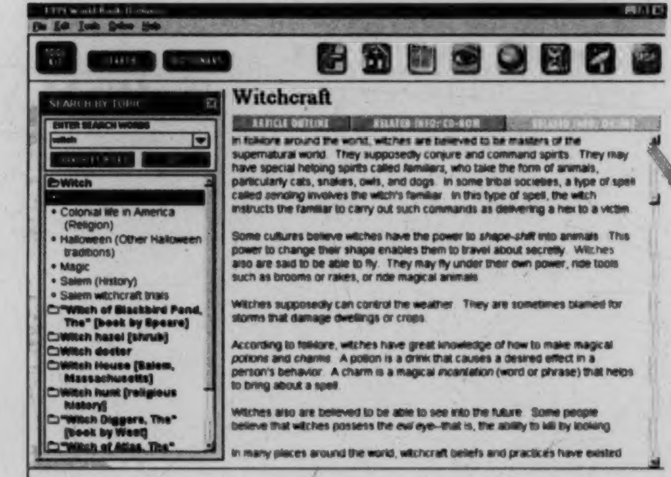
religion in the Middle Ages. Their effect on Western music up until the 16th century was monumental. In the Middle Ages, people did not regard sacred music

enough to invite some sort of embellishment. Related breathing rhythms, chanting, or other accompaniment, such as the tapping of a walking stick while walking or the transformation of a work tool into an instrument while working, may have been early forms of music. In fact, whether sacred Native American corn-gathering songs or melodies heard in elevators or supermarkets, music still accompanies our ceremonial and everyday activities.

Scholars can only speculate about when music began or which cultures had music first. From ancient times people have told stories of its origins. The so-called music of the spheres was thought by Greek philosopher and mathematician Pythagoras in the 6th century BC—and by later classical and medieval philosophers of the Western world—to be a perfectly harmonious music, inaudible on Earth, produced by the movement of the stars and planets. In many non-Western cultures

Carol quickly found the years that World War I happened and moved on to a more general look at witches and black cats. The question was fitting as the day of Carol's Search Session 3 was Halloween Dress Up Day at the school. She typed *witches and black cats*, *black cats* and then *witch*. She skimmed through the article and just read the section on changing shape to be a helping spirit to find an answer she was happy with. Figure 56 shows the search screen where Carol located the answer.

Figure 56: Witch Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
witch
Witch
• Colonial life in America (Religion)
• Halloween (Other Halloween traditions)
• Magic
• Salem (History)
• Salem witchcraft trials
"Witch of Blackbird Pond, The" [book by Speare]
Witch hazel [shrub]
Witch doctor
Witch House [Salem, Massachusetts]
Witch hunt [religious history]
"Witch Diggers, The" [book by West]
"Witch of Atlas, The"
Witchcraft
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

In folklore around the world, witches are believed to be masters of the supernatural world. They supposedly conjure and command spirits. They may have special helping spirits called *familiars*, who take the form of animals, particularly cats, snakes, owls, and dogs. In some tribal societies, a type of spell called *sending* involves the witch's familiar. In this type of spell, the witch instructs the familiar to carry out such commands as delivering a hex to a victim.

Some cultures believe witches have the power to *shape-shift* into animals. This power to change their shape enables them to travel about secretly. Witches also are said to be able to fly. They may fly under their own power, ride tools such as brooms or rakes, or ride magical animals.

Witches supposedly can control the weather. They are sometimes blamed for storms that damage dwellings or crops.

According to folklore, witches have great knowledge of how to make magical *potions* and *charms*. A potion is a drink that causes a desired effect in a person's behavior. A charm is a magical *incantation* (word or phrase) that helps to bring about a spell.

Witches also are believed to be able to see into the future. Some people believe that witches possess the *evil eye*—that is, the ability to kill by looking.

In many places around the world, witchcraft beliefs and practices have existed

Carol consistently used simple search terms to locate the answer. In most cases, she located a huge list of topics that were overwhelming to her. She then made her way through search terms that were more specific until she found a manageable list of topics. She was quite persistent and would read carefully to find an answer. Carol needed an average of 7 ½ minutes to find the answers to her questions. She was quite willing to stop when she felt like she had an acceptable answer or if she thought, "I don't think it is going to be in here."

5.9.5 Dave

"Maybe the answer is in it or something."

When Dave arrived for Search Session 3, he had clear questions based on his personal experience. He found the answers quickly and used simple search terms. It is interesting to note the change in his search terms over the three search sessions. Dave used natural language sentences in four of the eight previous searches. After talking in one of the Think Afters, Dave started using simple search terms and started having more success locating information to answer the questions. Table XV shows Dave's questions, time needed to find the answers, and his initial search terms.

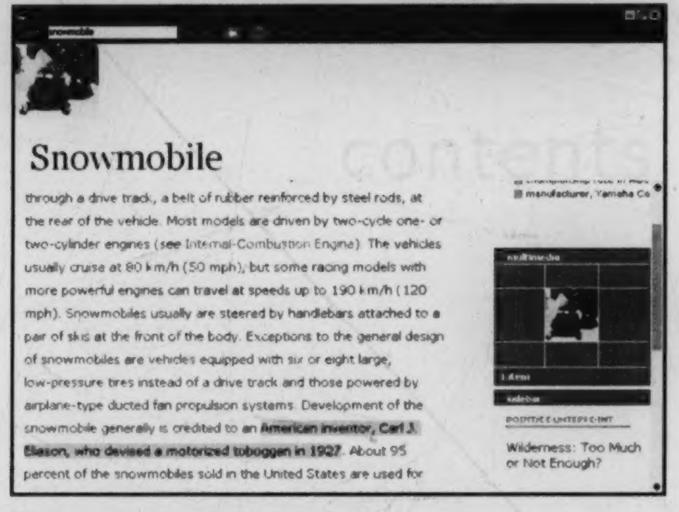
Table XVI: Dave's Search Session 3

Question	Time	Initial Search Term
Who invented skidoos?	05:56	*Skidoos*
Who invented computers?	02:51	*Computers*
Who invented hockey?	01:46	*Hockey*
Who invented baseball?	07:12	*Baseball*

Dave's first search was difficult because he was using the common term skidoos rather than snowmobiles. He eventually used *snowmobiles* as his search term and located an article on snowmobiles but the answer was not in the article. For the second question, Dave typed *computers* and located the answer very quickly. The same was true of the third question using the search term, *hockey*.

Dave decided to search for the answer to the snowmobile question using the other CD-ROM encyclopedia (Microsoft Encarta Encyclopedia Deluxe 2000). He typed in snowmobile and located an article and the answer right away. Figure 57 shows the search screen where he located the answer.

Figure 57: Snowmobile article in Microsoft Encarta Encyclopedia Deluxe 2000

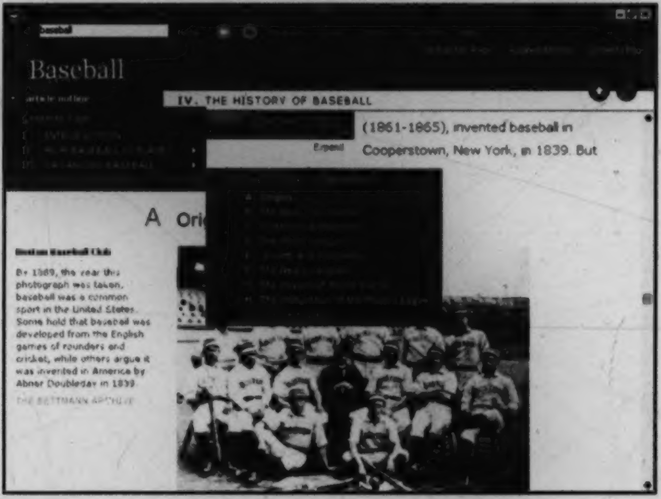


Snowmobile

through a drive track, a belt of rubber reinforced by steel rods, at the rear of the vehicle. Most models are driven by two-cycle one- or two-cylinder engines (see Internal-Combustion Engine). The vehicles usually cruise at 80 km/h (50 mph), but some racing models with more powerful engines can travel at speeds up to 190 km/h (120 mph). Snowmobiles usually are steered by handlebars attached to a pair of skis at the front of the body. Exceptions to the general design of snowmobiles are vehicles equipped with six or eight large, low-pressure tires instead of a drive track and those powered by airplane-type ducted fan propulsion systems. Development of the snowmobile generally is credited to an American inventor, Carl J. Eliason, who devised a motorized toboggan in 1927. About 95 percent of the snowmobiles sold in the United States are used for

Finding the answer to the fourth question was the most difficult for Dave because of his limited vocabulary. He spent a lot of time in the history of baseball section. Dave did not know what the word *origins* meant and failed to look in that section for a long time. Eventually, he did open that section and found the answer quite quickly after that. Figure 58 shows the search screen and the answer to the question.

Figure 58: Baseball article in Microsoft Encarta Encyclopedia Deluxe 2000



IV. THE HISTORY OF BASEBALL

(1861-1865), invented baseball in Cooperstown, New York, in 1839. But

Boston Baseball Club

By 1889, the year this photograph was taken, baseball was a common sport in the United States. Some hold that baseball was developed from the English games of rounders and cricket, while others argue it was invented in America by Abner Doubleday in 1839.

THE BETTMANN ARCHIVE

Although Dave became a more successful searcher over time, he still did not have a real sense of why he was typing in a search term. He stated, "Maybe the answer is in it or something." He struggled with the reading and did not have a lot of background knowledge to support his searching.. It was obvious that Dave felt more comfortable searching as time went on, but he still was quite hesitant compared to other searchers. Dave needed about 4 ½ minutes on average to find the answers to his questions.

5.9.6 Ken

"I don't know how to spell first."

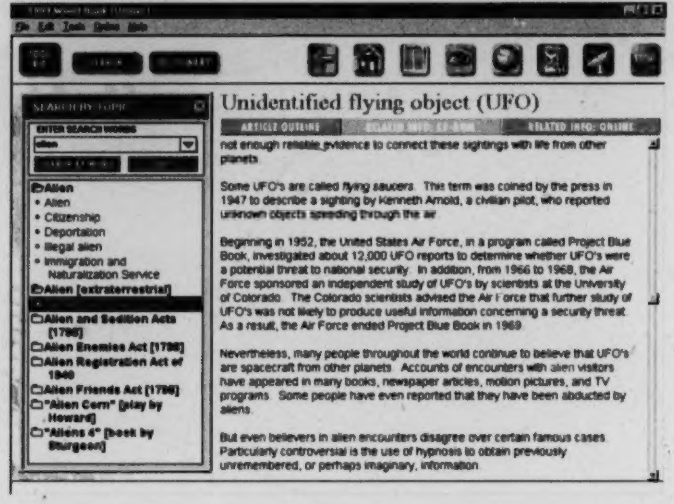
Ken brought four questions based on his personal interests to the final search session. He used natural language for each of his four initial search terms. As a result, it took him a little bit longer to locate the answers to the questions. Ken had many difficulties with search terms because of his inaccurate spellings.

Table XVII: Ken's Search Session 3

Question	Time	Initial Search Term
When did they find out about aliens?	04:59	*When did they find out about aliens*
What was the first team in hockey?	01:55	*What was the first team in hockey*
Which team won the most Stanley Cups?	04:43	*Which team won the most Stanley cups*
Which team in hockey has stayed in the longest?	06:12	*Which team for hockey stay in the longest*

Ken's first search began with the initial search term *when did they find out about aliens*. No topics were located. He tried the simple term *alien* next. A list of topics came up. The first few topics completely confused Ken. He clicked on an article called Alien and Sedition Acts but that was about also about US policy on immigration. Finally, he noticed Alien [extraterrestrial] on the list of topics and clicked on the article. He read the article and found a year that seemed to satisfy him. Figure 59 shows the search screen where he located an answer.

Figure 59: UFO Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
alien
Alien
• Alien
• Citizenship
• Deportation
• Illegal alien
• Immigration and Naturalization Service
Alien [extraterrestrial]
Alien and Sedition Acts [1798]
Alien Enemies Act [1798]
Alien Registration Act of 1940
Alien Friends Act [1798]
"Alien Corn" [play by Howard]
"Aliens 4" [book by Sturgeon]
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

Unidentified flying object (UFO)

not enough reliable evidence to connect these sightings with life from other planets.

Some UFO's are called flying saucers. This term was coined by the press in 1947 to describe a sighting by Kenneth Arnold, a civilian pilot, who reported unknown objects speeding through the air.

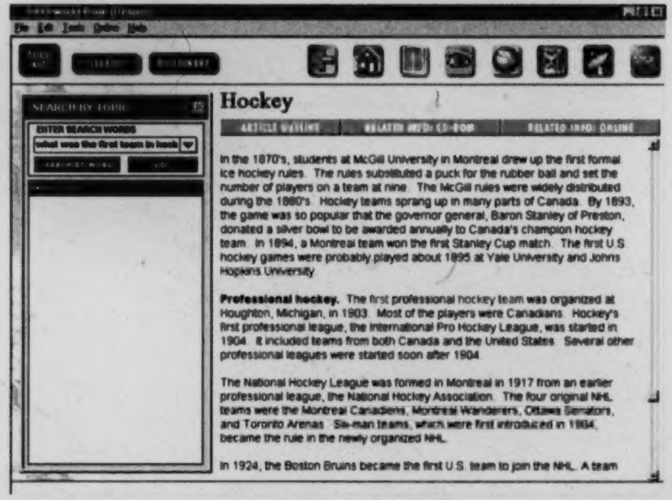
Beginning in 1952, the United States Air Force, in a program called Project Blue Book, investigated about 12,000 UFO reports to determine whether UFO's were a potential threat to national security. In addition, from 1966 to 1968, the Air Force sponsored an independent study of UFO's by scientists at the University of Colorado. The Colorado scientists advised the Air Force that further study of UFO's was not likely to produce useful information concerning a security threat. As a result, the Air Force ended Project Blue Book in 1969.

Nevertheless, many people throughout the world continue to believe that UFO's are spacecraft from other planets. Accounts of encounters with alien visitors have appeared in many books, newspaper articles, motion pictures, and TV programs. Some people have even reported that they have been abducted by aliens.

But even believers in alien encounters disagree over certain famous cases. Particularly controversial is the use of hypnosis to obtain previously unremembered, or perhaps imaginary, information.

Typing *what was the first team in hockey* located an article on hockey right away. Figure 60 shows the search screen where Ken located the answer to his question.

Figure 60: Hockey Article in 1999 World Book (Deluxe)


File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
what was the first team in hock
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

Hockey

In the 1870's, students at McGill University in Montreal drew up the first formal ice hockey rules. The rules substituted a puck for the rubber ball and set the number of players on a team at nine. The McGill rules were widely distributed during the 1880's. Hockey teams sprang up in many parts of Canada. By 1893, the game was so popular that the governor general, Baron Stanley of Preston, donated a silver bowl to be awarded annually to Canada's champion hockey team. In 1894, a Montreal team won the first Stanley Cup match. The first U.S. hockey games were probably played about 1895 at Yale University and Johns Hopkins University.

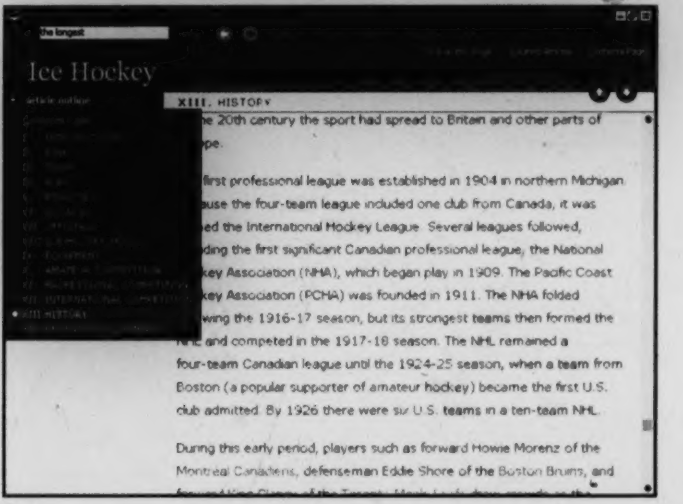
Professional hockey. The first professional hockey team was organized at Houghton, Michigan, in 1903. Most of the players were Canadians. Hockey's first professional league, the International Pro Hockey League, was started in 1904. It included teams from both Canada and the United States. Several other professional leagues were started soon after 1904.

The National Hockey League was formed in Montreal in 1917 from an earlier professional league, the National Hockey Association. The four original NHL teams were the Montreal Canadiens, Montreal Wanderers, Ottawa Senators, and Toronto Arenas. Six-man teams, which were first introduced in 1904, became the rule in the newly organized NHL.

In 1924, the Boston Bruins became the first U.S. team to join the NHL. A team

Ken already thought he knew the answer to his third question. He typed in *which team won the most Stanley Cups* as his initial search term and then clicked on Stanley Cup. From that article he linked to ice hockey and located a table listing all of the Stanley Cup winners. Ken counted the number of Montreal wins, and then checked Detroit and Toronto just to make sure that Montreal had the most wins. Ken's next question also had to do with hockey. He wanted to know which team had stayed in hockey the longest. He typed in *which team for hockey was in the longest*. He clicked on Rangers but quickly said, "This is the wrong one." He clicked on hockey and went to the history section. He read a little of the article and then said, "I think its Montreal." Figure 61 shows the search screen where Ken located his answer.

Figure 61: Ice Hockey Article in Microsoft Encarta Encyclopedia Deluxe 2000



he 20th century the sport had spread to Britain and other parts of pe.

first professional league was established in 1904 in northern Michigan use the four-team league included one club from Canada, it was ed the International Hockey League. Several leagues followed, ding the first significant Canadian professional league, the National key Association (NHA), which began play in 1909. The Pacific Coast key Association (PCHA) was founded in 1911. The NHA folded wing the 1916-17 season, but its strongest teams then formed the and competed in the 1917-18 season. The NHL remained a four-team Canadian league until the 1924-25 season, when a team from Boston (a popular supporter of amateur hockey) became the first U.S. club admitted. By 1926 there were six U.S. teams in a ten-team NHL.

During this early period, players such as forward Howie Morenz of the Montreal Canadiens, defenseman Eddie Shore of the Boston Bruins, and

Ken seemed to have a good idea about the answers to the last three questions. This background knowledge enabled him to eliminate topics and articles that were not appropriate. Ken used simple search terms in Search Session 1 but for the rest of the searches tended to use the whole question as the initial search term. The strategy seemed to work in Microsoft Encarta Encyclopedia Deluxe 2000 but Ken experienced difficulty when he found no topics in 1999 World Book (Deluxe). Inaccurate spelling was also a problem for Ken. At least three times during the search session, he asked how to spell *first*. Yet, Ken did manage to find an answer for every single question in the three search sessions. He needed an average of just over 5 minutes to find the answers.

5.9.7 Lynn

"Can I just see one thing."

Lynn's questions related to her personal experiences and interests. She was born in South Africa and her family loved rugby. In her Think Aloud she said,

> South Africa did not get to the finals on Saturday. It was so sad for me. It was against Australia. I can't believe France actually beat New Zealand. And South Africa beat France like by 30 points.

The final question came from the fact that she had just tried out for Anne of Green Gables school musical. The cast list was posted the following morning and Lynn won the role of Diana Barry. Lynn located the answers to three of her questions quite quickly. The third question was difficult because she could not find a definitive answer.

Table XVIII: Lynn's Search Session 3

Question	Time	Initial Search Term
When was rugby invented?	00:53	*When rugby invented*
When was television invented?	06:13	*When television was invented*
When was basketball invented?	01:50	*Who invented basketball*
When was Anne of Green Gables written?	01:08	*Anne of Green Gables*

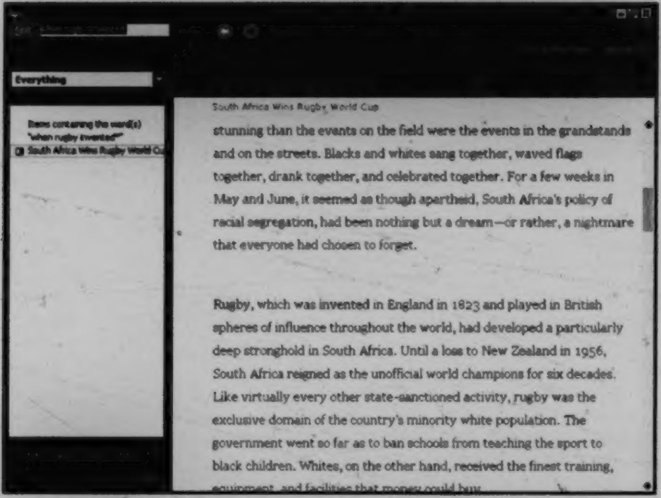
Lynn's initial search term *when rugby invented* located one article. Microsoft Encarta Encyclopedia Deluxe 2000 immediate loaded the article and Lynn located the answer right away. The highlighted words were very helpful. Figure 62 shows the search screen where Lynn found the answer.

Lynn typed in *when television was invented* as her initial search term for the next question. She located a list of articles and clicked on Baird, John Logie. In her Think Aloud she commented,

> When television was invented. Mm. He invented the first commercially viable apparatus to transmit and receive visual images. So that would be it, right?

But that did not answer the question, so Lynn continued looking at the list of articles and tried several other names. She found an answer that seemed to satisfy her in an article on Paul Nipkow. Figure 63 shows the search screen where Lynn located an answer.

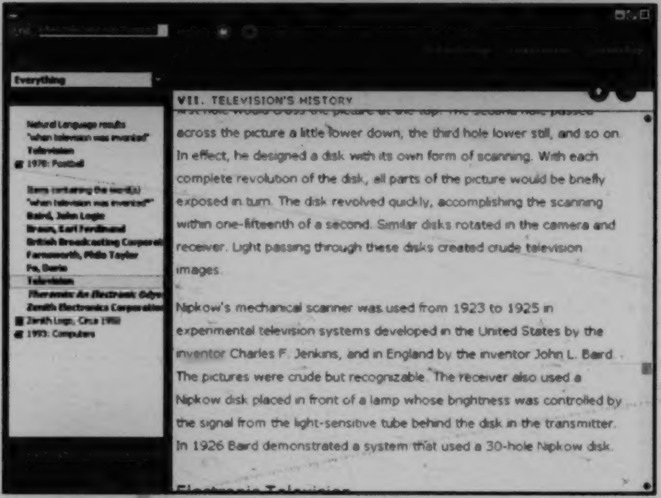
Figure 62: Rugby World Cup Article in Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Items containing the word(s)
"when rugby invented"
South Africa Wins Rugby World Cu
South Africa Wins Rugby World Cup

stunning than the events on the field were the events in the grandstands and on the streets. Blacks and whites sang together, waved flags together, drank together, and celebrated together. For a few weeks in May and June, it seemed as though apartheid, South Africa's policy of racial segregation, had been nothing but a dream—or rather, a nightmare that everyone had chosen to forget.

Rugby, which was invented in England in 1823 and played in British spheres of influence throughout the world, had developed a particularly deep stronghold in South Africa. Until a loss to New Zealand in 1956, South Africa reigned as the unofficial world champions for six decades. Like virtually every other state-sanctioned activity, rugby was the exclusive domain of the country's minority white population. The government went so far as to ban schools from teaching the sport to black children. Whites, on the other hand, received the finest training,

Figure 63: Television Article in Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Natural Language results
"when television was invented"
Television
1978: Football
Items containing the word(s)
"when television was invented"
Baird, John Logie
Braun, Karl Ferdinand
British Broadcasting Corporat
Farnsworth, Philo Taylor
Fo, Dario
Television
Theremin: An Electronic Odys
Zenith Electronics Corporatio
Zenith Logo, Circa 1950
1993: Computers
VII. TELEVISION'S HISTORY

across the picture a little lower down, the third hole lower still, and so on. In effect, he designed a disk with its own form of scanning. With each complete revolution of the disk, all parts of the picture would be briefly exposed in turn. The disk revolved quickly, accomplishing the scanning within one-fifteenth of a second. Similar disks rotated in the camera and receiver. Light passing through these disks created crude television images.

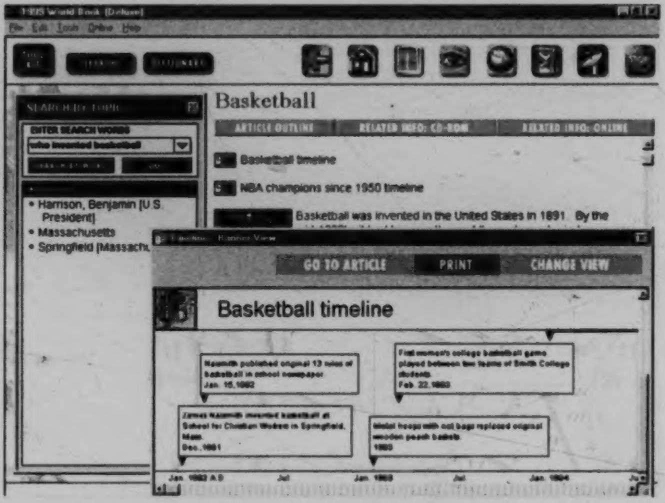
Nipkow's mechanical scanner was used from 1923 to 1925 in experimental television systems developed in the United States by the inventor Charles F. Jenkins, and in England by the inventor John L. Baird. The pictures were crude but recognizable. The receiver also used a Nipkow disk placed in front of a lamp whose brightness was controlled by the signal from the light-sensitive tube behind the disk in the transmitter. In 1926 Baird demonstrated a system that used a 30-hole Nipkow disk.

Lynn's initial search term for the next question was *who invented basketball*. The basketball article loaded immediately. Her Think Aloud was interesting as she commented,

> Basketball was invented in the United States in 1891. Michael Jordan was the best. I don't watch basketball anymore because the Bulls used to be my favorite team because they had all the best players. Naismith published the rules of basketball in 1892. James Naismith invented basketball in 1891. Yeah. He moved to the United States.

Figure 64 shows the search screen where Lynn located the answer.

Figure 64: Basketball Article in 1999 World Book (Deluxe)


1999 World Book (Deluxe)
File Edit Tools Online Help
SEARCH BY TOPIC
ENTER SEARCH WORDS
Basketball
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE
Basketball timeline
NBA champions since 1950 timeline
Harrison, Benjamin [U.S. President]
Massachusetts
Springfield [Massachu
GO TO ARTICLE
PRINT
CHANGE VIEW
Basketball timeline
Jan. 1892 A.D.
Jul
Jan. 1893
Jul
Jan. 1894

who invented basketball

Basketball was invented in the United States in 1891. By the

Naismith published original 13 rules of basketball in school newspaper
Jan. 15,1892

First women's college basketball game played between two teams of Smith College students
Feb. 22,1893

James Naismith invented basketball at School for Christian Workers in Springfield, Mass.
Dec.,1891

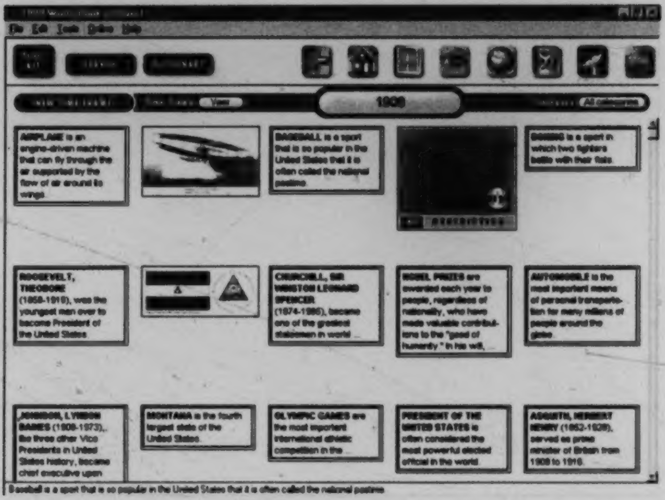
Metal hoops with net bags replaced original wooden peach baskets
1893

Lynn also quickly located the answer to the final question. She typed in *Anne of Green Gables* as her initial search term. An article on Canadian literature came up and Lynn read the highlighted words. She then clicked on the Lucy Maud Montgomery article to confirm the answer and said "Canadian author best known for her novel Anne of Green Gables in 1908. When her cursor passed over the year 1908, it changed to a sand timer. Her Think After followed her exploration of the function,

> What's this. 1908. Henry Ford. Winston Churchill. What did he do? Youngest man ever to be elected to government. That's pretty old.

One of the search screens that Lynn explored is found in Figure 65.

Figure 65: 1908 Timeline in 1999 World Book (Deluxe)



AIRPLANE is an engine-driven machine that can fly through the air supported by the flow of air around its wings.

BASEBALL is a sport that is so popular in the United States that it is often called the national pastime.

BOXING is a sport in which two fighters battle with their fists.

ROOSEVELT, THEODORE (1858-1919), was the youngest man ever to become President of the United States.

CHURCHILL, SIR WINSTON LEONARD SPENCER (1874-1965), became one of the greatest statesmen in world ...

NOBEL PRIZES are awarded each year to people, regardless of nationality, who have made valuable contributions to the "good of humanity." In his will, ...

AUTOMOBILE is the most important means of personal transportation for many millions of people around the globe.

JOHNSON, LYNDON BAINES (1908-1973), like three other Vice Presidents in United States history, became chief executive upon

MONTANA is the fourth largest state of the United States.

OLYMPIC GAMES are the most important international athletic competition in the ...

PRESIDENT OF THE UNITED STATES is often considered the most powerful elected official in the world.

ASQUITH, HERBERT HENRY (1852-1928), served as prime minister of Britain from 1908 to 1916.

Baseball is a sport that is so popular in the United States that it is often called the national pastime.

Lynn's searching can be characterized by the comment "Can I just see one thing." She was comfortable searching for all questions. She tried a variety of search terms when the first was unsuccessful. She was able to generate a variety of search terms quickly and felt free to explore. Her curiosity was apparent as she was the only participant to explore some of the additional features of the CD-ROM encyclopedia. Lynn needed an average of 2 ½ minutes to find the answers to her question.

5.9.8 Abby

"I can't find it in here."

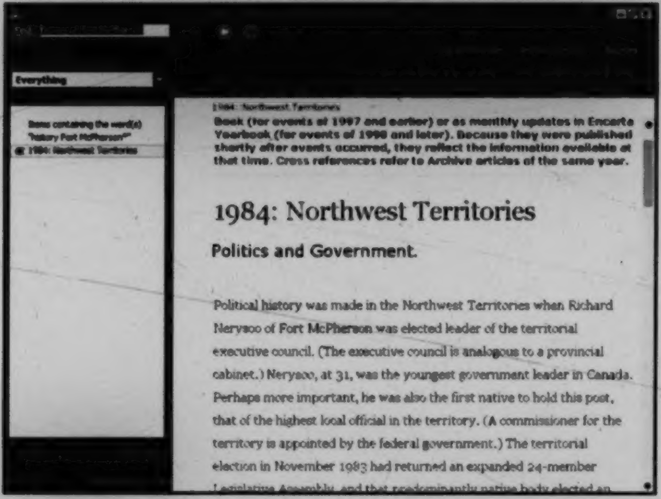
Abby had a lot of difficulty with her two questions. She did not bring questions to the session and came up with only two topics in which she was interested. Both topics had very little information and she became quite frustrated. The topics themselves did come from her personal experience. She is Gwich'in and Fort McPherson is her hometown and in Language Arts they were writing scary stories.

Table XIX: Abby's Search Session 3

Question	Time	Initial Search Term
History of Fort McPherson	14:58	*History of Fort McPherson*
Scary stories	13:40	*story*

Both topics of interest had very little information about them. Abby tried *history of Fort McPherson* in Microsoft Encarta Encyclopedia Deluxe 2000 and located only one topic. She decided to try her second question and search for *Fort McPherson* in 1999 World Book (Deluxe). Figure 66 shows the Microsoft Encarta Encyclopedia Deluxe 2000 search screen. Figure 67 shows the 1999 World Book (Deluxe) search screen.

Figure 66: 1984 Northwest Territories Article in Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Items containing the word(s) "history Fort McPherson"
1984: Northwest Territories

1984: Northwest Territories

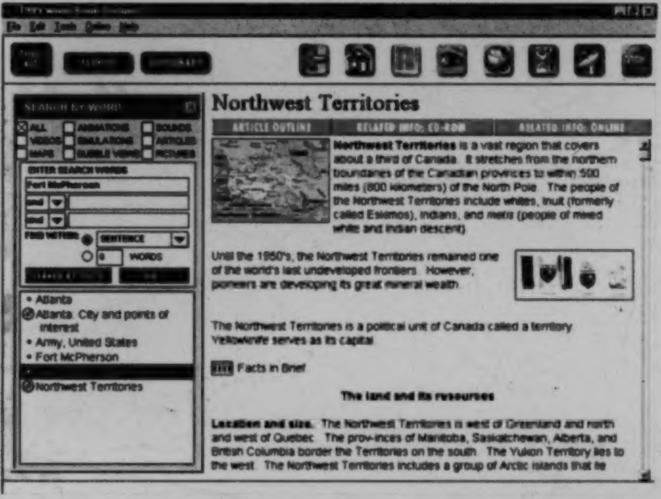
Book (for events of 1997 and earlier) or as monthly updates in Encarta Yearbook (for events of 1998 and later). Because they were published shortly after events occurred, they reflect the information available at that time. Cross references refer to Archive articles of the same year.

1984: Northwest Territories

Politics and Government.

Political history was made in the Northwest Territories when Richard Nerysoo of Fort McPherson was elected leader of the territorial executive council. (The executive council is analogous to a provincial cabinet.) Nerysoo, at 31, was the youngest government leader in Canada. Perhaps more important, he was also the first native to hold this post, that of the highest local official in the territory. (A commissioner for the territory is appointed by the federal government.) The territorial election in November 1983 had returned an expanded 24-member Legislative Assembly, and that predominantly native body elected an

Figure 67: Northwest Territories Article in 1999 World Book (Deluxe)


File Edit Tools Options Help
SEARCH BY WORD
☒ ALL ☐ ANIMATIONS ☐ SOUNDS
☐ VIDEOS ☐ SIMULATIONS ☐ ARTICLES
☐ MAPS ☐ BUBBLE VIEWS ☐ PICTURES
ENTER SEARCH WORDS
Fort McPherson
and
and
FIND WITHIN: ● SENTENCE
○ 0 WORDS
• Atlanta
Atlanta: City and points of interest
• Army, United States
• Fort McPherson
Northwest Territories
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE
Facts in Brief

Northwest Territories

Northwest Territories is a vast region that covers about a third of Canada. It stretches from the northern boundaries of the Canadian provinces to within 500 miles (800 kilometers) of the North Pole. The people of the Northwest Territories include whites, Inuit (formerly called Eskimos), Indians, and metis (people of mixed white and Indian descent).

Until the 1950's, the Northwest Territories remained one of the world's last undeveloped frontiers. However, pioneers are developing its great mineral wealth.

The Northwest Territories is a political unit of Canada called a territory. Yellowknife serves as its capital.

The land and its resources

Location and size. The Northwest Territories is west of Greenland and north and west of Quebec. The prov-inces of Manitoba, Saskatchewan, Alberta, and British Columbia border the Territories on the south. The Yukon Territory lies to the west. The Northwest Territories includes a group of Arctic islands that lie

Abby generated very little Think Aloud talk during both of these searches. She scrolled through each article she located and clicked on all topics in the list generated by the search by topic function.

Her final search was also unsuccessful. She began with the initial search term *story* and got a long list of articles. She next tried *scary story* but located no topics. The next search term was *horror* and scrolled through articles on Stephen King, Frankenstein, Mary Shelley, and Dracula. She seemed disappointed with the lack of information and decided to abandon the search and try 1999 World Book (Deluxe).

Abby used simple search terms throughout the three search sessions. She had the most difficulty of any participant locating answers. Part of this problem was that she had very little experience using CD-ROM encyclopedias. She also had limited background knowledge about the topics in search sessions. Abby's final questions were not ones that could locate good answers for her. She found the final search session experience quite frustrating. She spent an average of 14 minutes trying to find the answers to her questions. The comment "I can't find it in here" encapsulated Abby's experience in the final search.

5.9.9 Chris

"Is that as far as it goes?"

Chris came well prepared to the final search session. He brought four questions and was eager to search. The questions were based on personal interest and experience and he used simple search terms. He enjoyed exploring the encyclopedias and did not seem to be frustrated during this final search session.

Table XX: Chris' Search Session 3

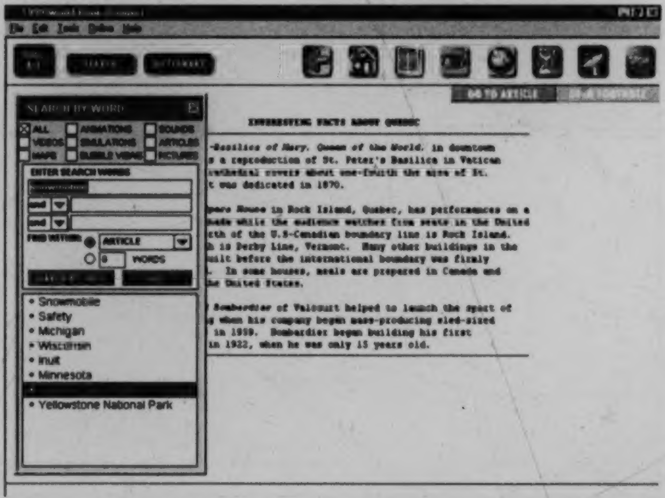
Question	Time	Initial Search Term
Who invented skidoos?	05:26	*Skidoos*
How many Nike shoes are made in a year?	05:10	*Nike shoes*
What is in rocket fuel tanks?	02:41	*Rocket fuel*
Who has the record for most goals scored in a season?	03:42	*Hockey records*

Chris typed in *skidoos* as his initial search term. When he located no article, he quickly typed in *snowmobiles* and list of topics came up. He clicked on transportation and read a small section of the article. He then added *inventors* to his search term. He did not locate any articles. Chris then tried the search by word function with the search terms *snowmobiles* and *inventors*. He located no topics. Next he tried *snowmobile* and the article on snowmobile came up. He explored the pictures in the article and located a date in the 1950s. His Think Aloud was interesting.

> There. In the 1950s but it does not say who yet. Ah. Hmm. Click on this. Helped to launch it. How do you launch it. Oh. Ah. Um. Joseph Armand Bombardier.

He spent time also looking in the Inuit article before clicking on an article on Quebec where he located the answer. Two participants asked this question and both found different answers within the same encyclopedia. Figure 68 shows the search screen where Chris located his answer.

Figure 68: Quebec Article in 1999 World Book (Deluxe)



- Snowmobile
- Safety
- Michigan
- Wisconsin
- Inuit
- Minnesota
-
- Yellowstone National Park

INTERESTING FACTS ABOUT QUEBEC

-Basilica of Mary, Queen of the World, in downtown
s a reproduction of St. Peter's Basilica in Vatican
cathedral covers about one-fourth the size of St.
t was dedicated in 1870.

pera House in Rock Island, Quebec, has performances on a
tage while the audience watches from seats in the United
rth of the U.S-Canadian boundary line is Rock Island.
h is Derby Line, Vermont. Many other buildings in the
uilt before the international boundary was firmly
. In some houses, meals are prepared in Canada and
he United States.

Bombardier of Valcourt helped to launch the sport of
g when his company began mass-producing sled-sized
in 1959. Bombardier began building his first
in 1922, when he was only 15 years old.

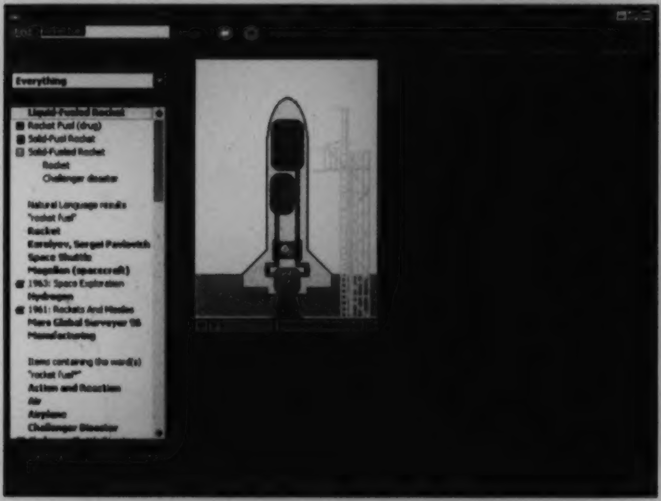
Chris' next question involved finding out how many shoes Nike makes in a year. He searched using *Nike shoes* but located no article. He tried the search by word using *Nike* and *shoes* but located no articles. His next search used just *Nike* and he found several articles. He tried Athena but realized quickly this was the wrong Nike. He clicked on Oregon and saw a number of 17 billion but that was the amount of manufacturing dollars for the whole state of Oregon. At this point, Chris decided to try Microsoft Encarta Encyclopedia Deluxe 2000 to find the answer. In his Think Aloud he said,

> Now what am I looking for? (typed in *Nike shoes*) Nike Incorporated. (clicked on Michael Jordan by mistake) Mike is the … for Nike in French. No. What did I get into? (clicked on Nike, Inc.) I do not know. . Funding. Oh. Is that as far as it goes? Table. It doesn't say anything.

He was unable to locate an answer.

The next question was very easy for Chris. He typed in *rocket fuel* as his initial search term and clicked on phencyclidine. This was an article about a street drug so Chris clicked back to the list of topics. He clicked on rocket and found an animated sequence explaining the combustion chamber of a rocket. Chris watched the sequence three times because it was very "cool." Figure 69 shows the search screen where Chris located his answer.

Figure 69: Rocket Article in Microsoft Encarta Encyclopedia Deluxe 2000


Everything
Rocket Fuel (drug)
Rocket
Challenger disaster
"rocket fuel"
Rocket
Space Shuttle
Magellan (spacecraft)
Hydrogen
"rocket fuel"
Action and Reaction
Air
Airplane
Challenger Disaster

Chris's final question was interesting as well. He had no idea who the person with the most goals in one season was until he began working through the search. His initial search term was *hockey records*. In his Think Alouds, he said,

> Did I say who? I am going to find out. I forget his name. Somebody told me it was Bobby Orr, I think it was. Forwards. Hmm. What about Phil Esposito? Hockey records… (changed to hockey goals) Oh. Was it Wayne Gretzky? I think it was. I do not know how I missed that. Everybody knows Wayne Gretzky. Mario Lemieux. I forgot about him

> too. (clicked on Wayne Gretzky) He played on how many teams? What was my question?

After thoroughly checking the records of other hockey players, Chris decided that Wayne Gretzky was the correct answer to his question.

Chris was an eager searcher. His Think Alouds were the most detailed and he felt comfortable talking about his searching. He was also keen to keep searching and felt it important to make sure his answers were correct. He asked a lot of questions of himself and of me throughout the process. He also seemed a little sad when the search sessions were over. He spent an average of just under 7 minutes trying to find the answers to his question.

5.9.10 Bob

"I studied these before in science."

Bob came well prepared to the final search session with a list of interesting questions. He seemed to have some general knowledge about each topic in which he was interested. He found the answers quite quickly except for question 3 which did not have an answer in the encyclopedia. Bob was keen to search and his Think Alouds were quite detailed.

Table XXI: Bob's Search Session 3

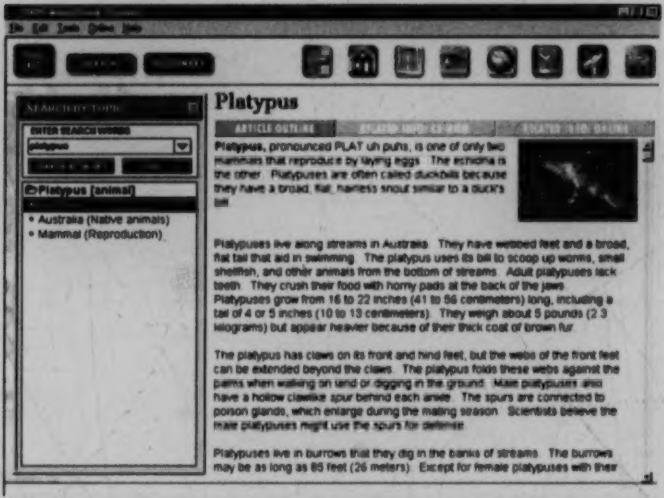
Question	Time	Initial Search Term
What is the duck-billed platypus?	00:18	*Platypus*
Who developed the atomic bomb?	02:50	*A bomb*
When did the first ape go into space	13:28	*Ape in space*
How does an electric guitar work?	03:23	*Guitar*

Bob's first search was quickly answered by typing in *platypus* and clicking on the picture. In his Think Aloud he said,

> Duck-billed platypus. I'll just try platypus. (typed in platypus) There we go. I studied these before in science. Their beak is soft like a leathery kind of texture. And their back feet have shoot out poison for self-defense.

Figure 70 shows the search screen where Bob located his answer.

Figure 70: Platypus Article in __1999 World Book (Deluxe)__



platypus

Platypus (animal)
- Australia (Native animals)
- Mammal (Reproduction)

Platypus

Platypus, pronounced PLAT uh puhs, is one of only two mammals that reproduce by laying eggs The echidna is the other Platypuses are often called duckbills because they have a broad, flat, hairless snout similar to a duck's bill

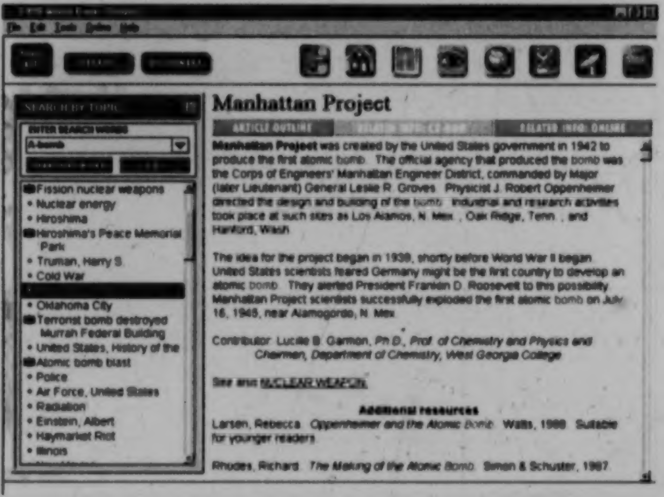
Platypuses live along streams in Australia They have webbed feet and a broad, flat tail that aid in swimming The platypus uses its bill to scoop up worms, small shellfish, and other animals from the bottom of streams Adult platypuses lack teeth They crush their food with horny pads at the back of the jaws Platypuses grow from 16 to 22 inches (41 to 56 centimeters) long, including a tail of 4 or 5 inches (10 to 13 centimeters) They weigh about 5 pounds (2 3 kilograms) but appear heavier because of their thick coat of brown fur

The platypus has claws on its front and hind feet, but the webs of the front feet can be extended beyond the claws The platypus folds these webs against the palms when walking on land or digging in the ground Male platypuses also have a hollow clawlike spur behind each ankle The spurs are connected to poison glands, which enlarge during the mating season Scientists believe the male platypuses might use the spurs for defense

Platypuses live in burrows that they dig in the banks of streams The burrows may be as long as 85 feet (26 meters) Except for female platypuses with their

The second question was also based on some background knowledge. Bob typed in *A-bomb* as his initial search term. He clicked on Albert Einstein and then linked to nuclear weapon. He saw the name Robert J. Oppenheimer and the Manhattan Project. In his Think After, Bob admitted that he knew some things already about the first two questions. Figure 71 shows the search screen where Bob located the answer to the question.

Figure 71: Manhattan Project Article in __1999 World Book (Deluxe)__



A-bomb

- Fission nuclear weapons
- Nuclear energy
- Hiroshima
- Hiroshima's Peace Memorial Park
- Truman, Harry S
- Cold War
- Oklahoma City
- Terrorist bomb destroyed Murrah Federal Building
- United States, History of the
- Atomic bomb blast
- Police
- Air Force, United States
- Radiation
- Einstein, Albert
- Haymarket Riot
- Illinois

Manhattan Project

Manhattan Project was created by the United States government in 1942 to produce the first atomic bomb The official agency that produced the bomb was the Corps of Engineers' Manhattan Engineer District, commanded by Major (later Lieutenant) General Leslie R Groves Physicist J Robert Oppenheimer directed the design and building of the bomb Industrial and research activities took place at such sites as Los Alamos, N Mex , Oak Ridge, Tenn , and Hanford, Wash

The idea for the project began in 1939, shortly before World War II began United States scientists feared Germany might be the first country to develop an atomic bomb They alerted President Franklin D Roosevelt to this possibility Manhattan Project scientists successfully exploded the first atomic bomb on July 16, 1945, near Alamogordo, N Mex

Contributor Lucille B Garmon, *Ph D , Prof of Chemistry and Physics and Chairman, Department of Chemistry, West Georgia College*

See also __NUCLEAR WEAPON__

Additional resources

Larsen, Rebecca *Oppenheimer and the Atomic Bomb* Watts, 1988 Suitable for younger readers

Rhodes, Richard *The Making of the Atomic Bomb* Simon & Schuster, 1987

Bob's question three was a little bit confusing for him. He was positive that there had been an ape in space and when his search terms failed to locate any information he was a little baffled. He tried *monkey in space* and then *animal in space*. In his Think Aloud he commented,

> Yeah. I was looking at that. Sputnik's in here? Mm. He was on the Challenger. There doesn't seem to be anything.

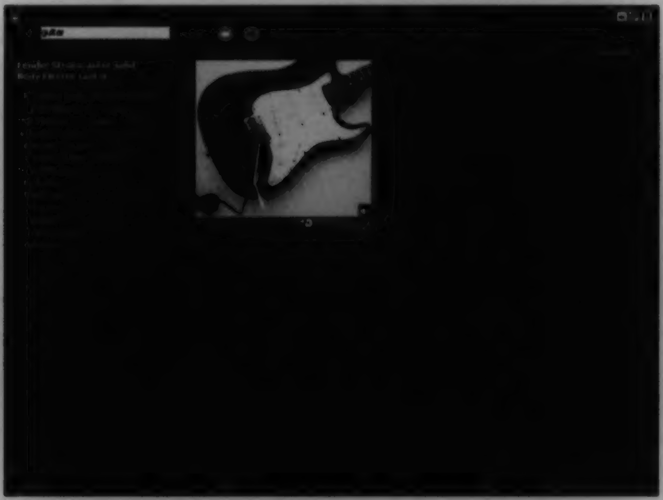
Yet, Bob was easily adaptable to trying new search terms and new ideas when his original question seemed not to find an answer. He did locate information on a dog and a monkey in space.

Bob told me in the initial interview that he played the guitar so I was not surprised to see a question on electric guitars in his final search session. Bob's Think Aloud was quite interesting as he knew more than was in the article. He said,

> Very nice. No. I just want to hear it. Cool. See those little dots? Those are pickups. They're like tiny magnets and whenever you play the strings it vibrates. Let's say that my finger is the pickup. It goes past and it makes a sound whenever it goes past it. Yup.

Figure 72 shows the search screen where Bob located an answer.

Figure 72: Guitar Article in Microsoft Encarta Encyclopedia Deluxe 2000



The statement "I studied it before in science" described Bob as a searcher. He had a lot of background knowledge that he brought to all three search sessions. When doing Think Alouds and searching for answers, Bob used any and all knowledge that he had that related to the topic. In Search Session 1, Bob used *space shuttle* as his initial search term when looking for the first woman in space. He knew something about the Welland Canal and knew that the Tropic of Cancer was the north one. When developing his own questions, he knew something about each one and was able to highlight the search with this information. Bob spent an average of 5 minutes searching for answers to his questions.

5.9.11 Mary

"I'm typing in Amsterdam. Clicking Amsterdam."

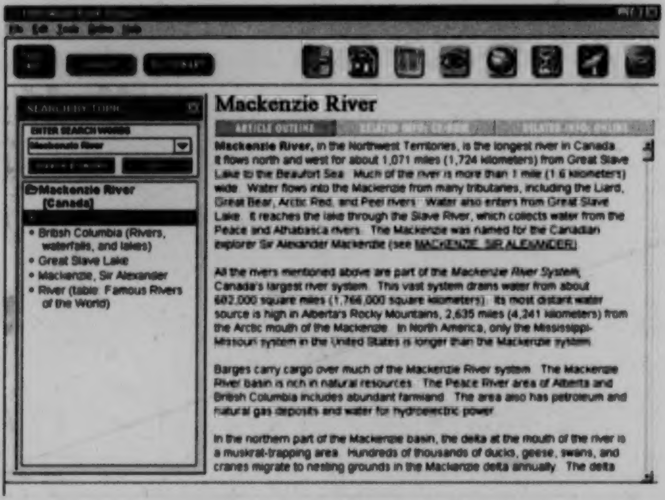
Mary's questions definitely related to her personal experience and interests. She has lived her whole life on or near the Mackenzie River and she is an Inuk. The other questions related to things she was curious about. Mary was a capable searcher who methodically located information. Her Think Alouds were descriptions of what she was doing rather than what she was thinking.

Table XXII: Mary's Search Session 3

Question	Time	Initial Search Term
What is the length of the Mackenzie River?	03:36	*Mackenzie River*
What does Inuit mean?	01:10	*Inuit*
Where is Amsterdam?	02:29	*Amsterdam*
Who is a famous race car driver?	04:32	*Race car driver*

Mary used the initial search term *Mackenzie River* and located several articles in 1999 World Book (Deluxe). On her first scroll through the article she missed the length of the river but on the way back up she found the answer. Figure 73 shows the search screen where she located the answer.

Figure 73: Mackenzie River Article in 1999 World Book (Deluxe)



Mackenzie River [Canada]

- British Columbia (Rivers, waterfalls, and lakes)
- Great Slave Lake
- Mackenzie, Sir Alexander
- River (table: Famous Rivers of the World)

Mackenzie River

Mackenzie River, in the Northwest Territories, is the longest river in Canada. It flows north and west for about 1,071 miles (1,724 kilometers) from Great Slave Lake to the Beaufort Sea. Much of the river is more than 1 mile (1.6 kilometers) wide. Water flows into the Mackenzie from many tributaries, including the Liard, Great Bear, Arctic Red, and Peel rivers. Water also enters from Great Slave Lake. It reaches the lake through the Slave River, which collects water from the Peace and Athabasca rivers. The Mackenzie was named for the Canadian explorer Sir Alexander Mackenzie (see MACKENZIE, SIR ALEXANDER).

All the rivers mentioned above are part of the *Mackenzie River System*, Canada's largest river system. This vast system drains water from about 682,000 square miles (1,766,000 square kilometers). Its most distant water source is high in Alberta's Rocky Mountains, 2,635 miles (4,241 kilometers) from the Arctic mouth of the Mackenzie. In North America, only the Mississippi-Missouri system in the United States is longer than the Mackenzie system.

Barges carry cargo over much of the Mackenzie River system. The Mackenzie River basin is rich in natural resources. The Peace River area of Alberta and British Columbia includes abundant farmland. The area also has petroleum and natural gas deposits and water for hydroelectric power.

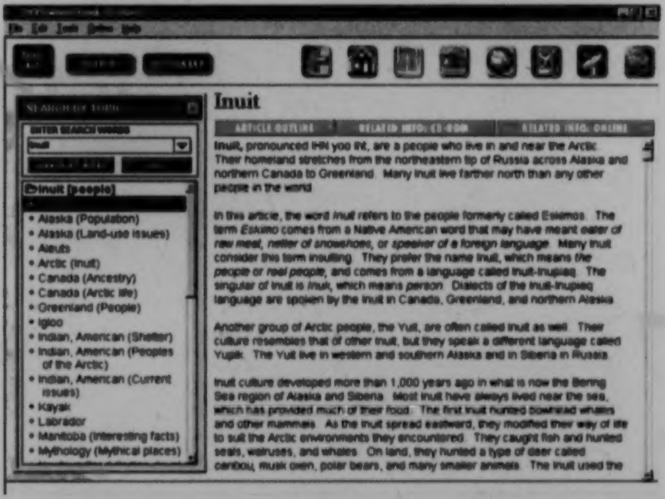
In the northern part of the Mackenzie basin, the delta at the mouth of the river is a muskrat-trapping area. Hundreds of thousands of ducks, geese, swans, and cranes migrate to nesting grounds in the Mackenzie delta annually. The delta

Her second question was also quickly located. She typed in *Inuit* as her initial search term and the article came up. She quickly skimmed through the article and said,

> Typing Inuit. The people or real people. Inuk which means person. Language spoken in Northern Canada, Greenland, and Northern Alaska.

Figure 74 shows the search screen where she located the answer.

Figure 74: Inuit Article in 1999 World Book (Deluxe)



Inuit [people]

- Alaska (Population)
- Alaska (Land-use issues)
- Aleuts
- Arctic (Inuit)
- Canada (Ancestry)
- Canada (Arctic life)
- Greenland (People)
- Igloo
- Indian, American (Shelter)
- Indian, American (Peoples of the Arctic)
- Indian, American (Current issues)
- Kayak
- Labrador
- Manitoba (Interesting facts)
- Mythology (Mythical places)

Inuit

Inuit, pronounced IHN yoo iht, are a people who live in and near the Arctic. Their homeland stretches from the northeastern tip of Russia across Alaska and northern Canada to Greenland. Many Inuit live farther north than any other people in the world.

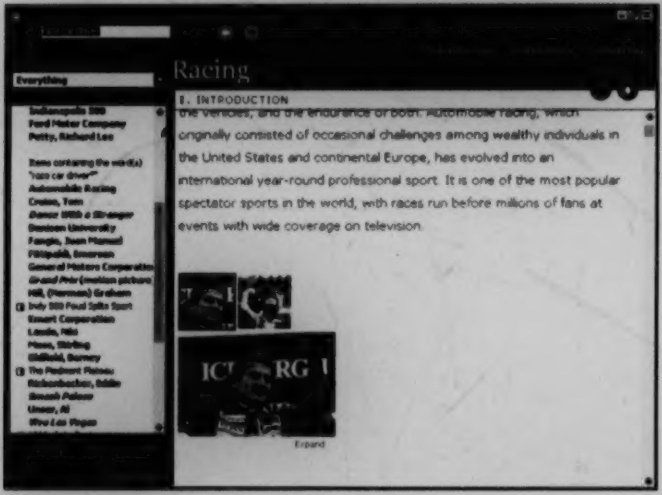
In this article, the word *Inuit* refers to the people formerly called Eskimos. The term *Eskimo* comes from a Native American word that may have meant *eater of raw meat*, *netter of snowshoes*, or *speaker of a foreign language*. Many Inuit consider this term insulting. They prefer the name Inuit, which means *the people* or *real people*, and comes from a language called Inuit-Inupiaq. The singular of Inuit is *Inuk*, which means *person*. Dialects of the Inuit-Inupiaq language are spoken by the Inuit in Canada, Greenland, and northern Alaska.

Another group of Arctic people, the Yuit, are often called Inuit as well. Their culture resembles that of other Inuit, but they speak a different language called Yupik. The Yuit live in western and southern Alaska and in Siberia in Russia.

Inuit culture developed more than 1,000 years ago in what is now the Bering Sea region of Alaska and Siberia. Most Inuit have always lived near the sea, which has provided much of their food. The first Inuit hunted bowhead whales and other mammals. As the Inuit spread eastward, they modified their way of life to suit the Arctic environments they encountered. They caught fish and hunted seals, walruses, and whales. On land, they hunted a type of deer called caribou, musk oxen, polar bears, and many smaller animals. The Inuit used the

Mary answered her next two questions using Microsoft Encarta Encyclopedia Deluxe 2000. She typed in *Amsterdam* as her initial search term and clicked on Amsterdam (Netherlands). Mary located a map of Europe and located countries near to the Netherlands. She also explored the article and looked at some of the pictures of the city. Mary was also interested in famous race car drivers(See Figure 75). This question located several names that she explored but did not really know who in particular she was interested in. Mary seemed satisfied with the list of articles she located.

Figure 75: Racing Article in Microsoft Encarta Encyclopedia Deluxe 2000



Indianapolis 500
Ford Motor Company
Petty, Richard Lee

Items containing the word(s) "race car driver"
Automobile Racing
Cruise, Tom
Dance With a Stranger
Denison University
Fangio, Juan Manuel
Fittipaldi, Emerson
General Motors Corporation
Grand Prix (motion picture)
Hill, (Norman) Graham
Indy 500 Fuel Spills Sport
[illegible] Corporation
Lauda, Niki
Moss, Stirling
Oldfield, Barney
The Piedmont Plateau
Rickenbacker, Eddie
Smash Palace
Unser, Al
Viva Las Vegas

the vehicles, and the endurance of both. Automobile racing, which originally consisted of occasional challenges among wealthy individuals in the United States and continental Europe, has evolved into an international year-round professional sport. It is one of the most popular spectator sports in the world, with races run before millions of fans at events with wide coverage on television.

Mary used simple search terms during all three of the search sessions. She was able to successfully locate all answers to the questions. She needed an average of almost 3 minutes to answer her questions. She did not necessarily have a lot of background knowledge but was able to determine relevant and irrelevant articles quite easily. During the three search sessions, she had difficulty doing the Think Alouds. Mary is a very quiet person and Thinking Aloud seemed quite difficult for her. She seemed to confuse Thinking Aloud with describing the actual physical tasks she was carrying out. Even though I reminded her often just to Think Aloud, she reverted to the description of her clicking, typing and reading.

5.9.12 Sue

"I have heard of it before but I don't know what it is."

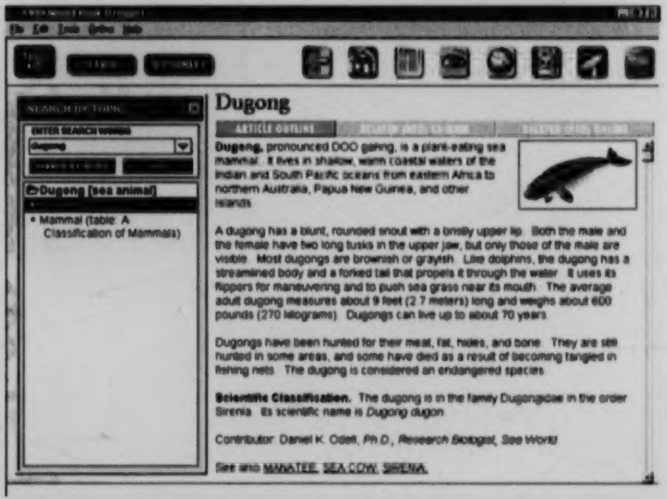
Sue is quite interested in science and is a good student. She brought questions to the third search session that reflected those interests. She was very curious and spent a lot of her time going to the other links she located in articles. Sue spent a lot of time on questions two and three. It was not that she could not locate the answer to the article but she was so interested in the questions she read every word out loud.

Table XXIII: Sue's Search Session 3

Question	Time	Initial Search Term
What is a dugong?	00:35	*Dugong*
How does a star disintegrate?	07:49	*Disintegration of stars*
What life is there on other planets?	12:17	*Life on other planets*

Sue typed *dugong* as her initial search term for question one (See Figure 76).

Figure 76: Dugong Article in 1999 World Book (Deluxe)



Dugong

Dugong, pronounced DOO gahng, is a plant-eating sea mammal. It lives in shallow, warm coastal waters of the Indian and South Pacific oceans from eastern Africa to northern Australia, Papua New Guinea, and other islands.

A dugong has a blunt, rounded snout with a bristly upper lip. Both the male and the female have two long tusks in the upper jaw, but only those of the male are visible. Most dugongs are brownish or grayish. Like dolphins, the dugong has a streamlined body and a forked tail that propels it through the water. It uses its flippers for maneuvering and to push sea grass near its mouth. The average adult dugong measures about 9 feet (2.7 meters) long and weighs about 600 pounds (270 kilograms). Dugongs can live up to about 70 years.

Dugongs have been hunted for their meat, fat, hides, and bone. They are still hunted in some areas, and some have died as a result of becoming tangled in fishing nets. The dugong is considered an endangered species.

Scientific Classification. The dugong is in the family Dugongidae in the order Sirenia. Its scientific name is *Dugong dugon*.

Contributor: Daniel K. Odell, *Ph.D., Research Biologist, Sea World.*

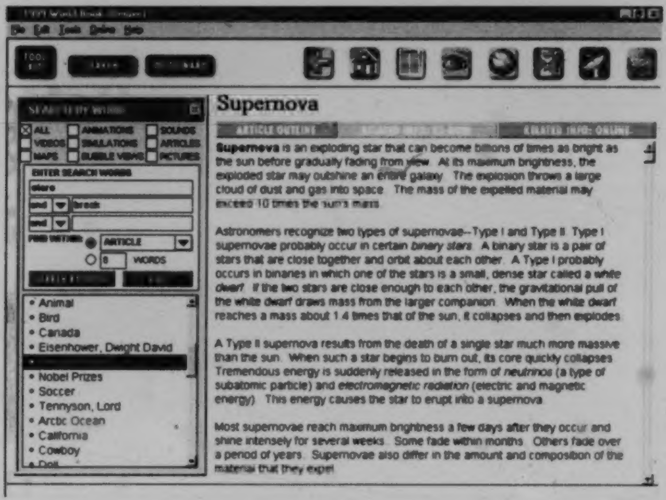
See also MANATEE; SEA COW; SIRENIA.

She quickly located the answer and read,

> Yeah, brownish or greyish, like dolphins streamlined body and forked tail… seagrass into mouth… average adult… 9 feet 2.7 metres… live up to seventy years… Cool. Hunted for their meat, fat, hides, and bone.

For the second question, Sue typed in *disintegration of stars* and found no topics. Using the search by word function, she typed in *disintegration* and *stars* and then *stars* and *break*. She located several topics and clicked on neutron star and from that article went to supernova (See Figure 77).

Figure 77: Supernova Article in 1999 World Book (Deluxe)



stars
and ▼ break
and ▼
FIND WITHIN: ● ARTICLE ▼
○ 8 WORDS

- Animal
- Bird
- Canada
- Eisenhower, Dwight David
- Nobel Prizes
- Soccer
- Tennyson, Lord
- Arctic Ocean
- California
- Cowboy

Supernova

Supernova is an exploding star that can become billions of times as bright as the sun before gradually fading from view. At its maximum brightness, the exploded star may outshine an entire galaxy. The explosion throws a large cloud of dust and gas into space. The mass of the expelled material may exceed 10 times the sun's mass.

Astronomers recognize two types of supernovae--Type I and Type II. Type I supernovae probably occur in certain *binary stars*. A binary star is a pair of stars that are close together and orbit about each other. A Type I probably occurs in binaries in which one of the stars is a small, dense star called a *white dwarf*. If the two stars are close enough to each other, the gravitational pull of the white dwarf draws mass from the larger companion. When the white dwarf reaches a mass about 1.4 times that of the sun, it collapses and then explodes.

A Type II supernova results from the death of a single star much more massive than the sun. When such a star begins to burn out, its core quickly collapses. Tremendous energy is suddenly released in the form of *neutrinos* (a type of subatomic particle) and *electromagnetic radiation* (electric and magnetic energy). This energy causes the star to erupt into a supernova.

Most supernovae reach maximum brightness a few days after they occur and shine intensely for several weeks. Some fade within months. Others fade over a period of years. Supernovae also differ in the amount and composition of the material that they expel.

Sue's final question was because "they found fossils or something". She typed in *life on other planets* as an initial search term. This lead her to an article on planetary science and from there to an article on exobiology. She spent quite a long time reading the exobiology article. Although she did not locate a definitive answer, she did seem satisfied with the information that she found and decided to stop the search.

Sue was a very curious student. She went to more links within articles than any other searcher. Sue used simple search terms throughout all three of the search sessions. She found the answer to every question to her satisfaction and was always quite happy to be in the session. Sue needed almost 7 minutes to answer her questions. Her Think Alouds were fairly detailed and she read much of the information out loud. This suggested she was quite comfortable with reading. The comment "I have heard of it before but I don't know what it is" is quite a good way of thinking about Sue as a searcher. She had some background knowledge or had at least some idea about most of the questions so that she was able to work through topics, articles and links confidently.

5.11 Search Session 3 Summary

Search Session 3 provided some very interesting approaches to information seeking on CD-ROM encyclopedias. All of the participants generated questions that were important to their personal lives and interests. Most of the questions were ones that could be found in an encyclopedia. Abby spent the most amount of time finding the answers to her questions while Eric and Lynn spent the least amount of time. The mean amount of time needed to answer their self-generated questions was just over six minutes.

Eric used natural language sentences when searching for most of his answers. This was a departure from the way he had previously searched. Paul continued to search in the same way during his final search session. He was interested in information in general and was not looking for specific answers. Paul felt free to explore the information and was not worried about finding the answer right away. Fran continued to be easily frustrated when the answer was not found immediately after typing in an initial search term. Carol still typed in general search terms to find answers to her questions. This made it difficult for her to make her way through the large number of retrieved topics. Dave used general topics for search terms as well. This worked well for him compared to his earlier searching when he was typing in the whole question. Ken used the whole question as an initial search for each of his final questions. He did not do this during the first two search sessions. Lynn continued to be a very effective searcher. She was confident and found all but one of the answers easily. Lynn also enjoyed exploring some of the features of the encyclopedia. Abby chose questions that were very difficult to find in an encyclopedia. She did not really have a sense of what kind of information might be in an encyclopedia.

Chris continued to use simple search terms to locate information. Two of his questions were difficult to answer using an encyclopedia. Bob had difficulty with one question. The rest of the questions he found easily. He continued to use general search terms to find the answers. Mary found the answers to her first three questions easily. The fourth question was not specific and, therefore, it was difficult for her to find an answer. Instead she just spent time reading about a lot of racecar drivers rather than finding one famous racecar driver. Sue's questions were based on her interest in science. She found the answer to her first question quickly but the second two took much longer. She was very interested in the topic and spent a lot of time reading about the disintegration of stars and exobiology.

5.11 Key Informants

There were many people in the school who volunteered to be key informants for this research study. However, only four were selected. One teacher was selected from each grade, that is, seven, eight, and nine. The other key informant had multiple roles in the school including Library Assistant and Special Needs Assistant. The four key informants were asked the following questions:

1. How much time do you spend per week on the computer?
2. What is your own CD-ROM encyclopedia expertise?
3. What things do you think influence your own searching on CD-ROM encyclopedias, the Internet, print encyclopedias, OPACs and card catalogues?
4. What factors do you think influence junior high students' information-seeking processes?

All four of the key informants use computers at SHSS and 3 of them have computers at home. Teachers have computers on their classroom desks and are responsible for entering attendance, report card marks and comments onto it as part of their job. Mrs. K. spends the most time using computers, more than 5 hours per day. She is actively involved in bulletin boards and chat rooms as well as searching the Internet for work and for pleasure. Ms. A. uses the computer about an hour per day. She is taking distance education courses and spends time searching the Internet for information and writing papers. Ms. B. uses computers very little at school or at home. She searched the Internet more last year because she had a small class who were quiet workers. This year she does not have that kind of quiet time. She often asks her husband to find information for her using the Internet and CD-ROM encyclopedias. Mr. I. occasionally uses the computer at school to find information on jobs in foreign countries and travel information. He also uses it to locate information that supports his classroom teaching. He does not have a computer at home so does not spend time outside of work using a computer.

Mrs. K. told me that she rarely uses a CD-ROM encyclopedia. She preferred to use the Internet for her personal information seeking. There are no CD-ROM encyclopedias in the junior high computer lab, so Mrs. K. does not teach the junior high students how to use them. Ms. A. helps students use CD-ROM encyclopedias in the library but she does not use them herself. She "has Encarta at home but does not know how to use it." Mr. I. lived with his brother for several years and he had a computer. They had both World Book and Encarta at home. Mr I. felt "using the CD is just like using a regular encyclopedia. If it is in there, I can find it." Ms. B. has Encarta at home but she rarely used it.

Mrs. K. felt very confident searching on the Internet. She said that having the time to learn and make mistakes was very important. Mrs. K. thought it was important to understand the workings of a couple of search engines. She used "AltaVista almost exclusively." Ms. A. said that the most important factor in her success was finding the right keyword. She believed that different search engines did different things so she tended to stick to AltaVista. She said another factor for her success was time. Where she researched depended on how much time she had. For Mr. I., success came from knowing when to "narrow the search and type in exactly what you want" and when to "back up in my head to a more general topic to find the answer." Mr. I. admitted that he is fairly impatient when searching on the Internet and will only stick with it for so long. When in doubt, he asked others for help. He talked about asking the Senior High Computer Teacher for some tips to teach to his grade seven students. Ms. B said that she "was a brutal searcher" who got "just as frustrated as the kids." She stated that she has rarely ever found what she was looking for when searching on the Internet. For her to use the computer, it has to be really important. Usually, she found it "way easier to go to the library and get a book."

The key informants had many interesting insights into the factors that influence the information-seeking processes of junior high students. Mr. I. and Ms. B have both taught in the same grade in junior high for three years. Mrs. K. has been teaching computer class to junior high students for over ten years. Ms. A. brings a different perspective as a Library Assistant and Special Needs Assistant. These factors will be discussed in a later section.

5.12 Dissertation Questions

The following three questions provided the starting point for this research:

- What information-seeking processes do junior high students use when accessing CD-ROM encyclopedias?
- How similar and different are these information-seeking processes when junior high students search for information on self-generated, teacher-generated and researcher-generated topics?
- What factors do participants, key informants and the researcher see as important to an understanding of the information-seeking processes of junior high students?

It is important to provide answers to these questions at this point in the findings.

5.12.1 Information-seeking Processes

Information-seeking processes are the processes that include selecting a search term, reading, selecting, viewing, determining relevance of topics and articles, and locating the answer. They also include skills, strategies, and metacognitive processes. The junior high students in this study used a variety of information-seeking processes while searching for information on CD-ROM encyclopedias. There were some expectations before data collection that there might have been differences based on cultural background, age, grade, gender, experience and reading ability. However, in spite of the rich variety of experiences brought to the study by the participants, there were no marked differences found in these information-seeking processes.

The participants in this study all began their search by typing something into the search box. Participants tended to use the terms from the question as a starting point. Rarely did participants generate totally new terms, for example, Paul used *astronauts*, Chris used *space geographers*, and, Abby used *Kings of Egypt*. The search term could be a single word, for example, *Alaska*, a phrase, for example, *first woman in space*, or, all or most of the original question, for example, *what a boxer dog looks like*. When typing in search terms, almost all participants rehearsed or repeated what they were typing as they typed it.

The search term entered either retrieved a list of topics or gave the message "no topics found". At that point, participants had to determine what to do next. When faced with "no topics found", the usual approach was to try another search term. Participants asked for help at this point, sat quietly and thought about another search term, were frustrated, were confused, and some immediately tried a different term. The length of time needed to generate another search term varied greatly between participants. Lynn, for example, quickly tried other variations on her search term. Dave and Abby would sit and think for a while before trying another search term. Some of the participants needed a little encouragement to get them started again. Others were anxious to try again.

When an initial search term retrieved a list of topics, the participants were then faced with selecting one to view. Often this was difficult, as the list of topics could be very long. Participants with any background knowledge tended to use it when faced with the list of retrieved topics. The transcripts showed that some participants used a process of elimination at this point. Most of the participants skimmed through the list looking for a topic that seemed relevant. If they found a topic that they felt was relevant they would click on it to take them to the article. When faced with a list of unfamiliar topics, several of the participants used the strategy of working from top to bottom. This was especially true of, for example, the first woman in space question, the population of the capital city of Alaska in 1996 question, and, a country that the equator passes through question. Some of the participants had difficulty determining relevant articles from the list. This may have been due to several factors, such as, reading ability, background knowledge, and, understanding of the question. Those participants who were the weakest students, according to their teachers, had the most difficulties determining relevance. As a result their searches took longer. They also tended to be the ones who were unable to find an answer.

When in an article, participants read or skimmed the article depending on its length. If the search terms were highlighted, several of the participants would scan the article looking for those terms. With long articles, I encouraged participants to look at the article outline. Some of them skimmed the list of sections within the article outline before going directly to the article. Others moved back and forth between the article outline and the article itself. Shorter articles, on the whole, were read more carefully than longer articles. Most of the participants knew that the size of the bar on the vertical scroll determined the length of the article. They would use that to determine whether to read or to skim the article.

Once the participants were in a relevant article, they were usually able to locate the answer quickly. Even those students who were poor readers managed to locate the answer in the text, even if it took a little bit longer. Several times participants missed the answer while skimming through the article and started reading again. In almost every case, they saw the answer the second time through the article. Several times, participants tried another search term and ended up in the same article and then located the answer. Participants tended to read the answer out loud to me when they located it. Usually a sense of relief or accomplishment was apparent at this stage in the search.

The participants tended to perform three main processes. They entered search terms, skimmed through the list of retrieved topics to find a relevant article, and, read, skimmed or scanned through article outlines and articles to find the answer. Sometimes the participant had to return to the list of retrieved topics many times after being unable to locate the relevant article that contained the answer, had to type in several search terms, and had to look through many articles and article outlines to find the answer. These three processes seem to be the most important to the search. Skills can be taught to help students be more successful at each step.

5.12.2 Search Sessions 1, 2 and 3

Most participants were able to find the answers to the questions in Search Sessions 1, 2 and 3. There was some expectation that the information-seeking processes of the participants would be different depending on whether the questions were researcher-generated, teacher-generated or self-generated. However, the information-seeking processes of the participants proved to be the same over the three search sessions. The participants continued to type in a search term, select relevant topics from the retrieved list and skim, scan and read the article outlines and articles. The only changes that were noticed were the selection of search terms and the confidence with navigation. Eric, Ken and Lynn began using most or all of the question as an initial search term in Search Session 3, for example, *who won the first Stanley Cup*, *when did they find out about aliens*, *when television was invented*. This strategy was very different from their choice of initial search terms in Search Sessions 1 and 2. During the earlier searches, all three participants used words or phrases directly from the question but never used the whole question as a search term. They gave no reasons in the Think Alouds or Think Afters for the change.

Dave, on the other hand, used the complete question as a search term twice in Search Session 1 and twice in Search Session 2, for example, *who was the first woman in space*, and *what a boxer dog looks like*. However, by Search Session 3 he was using a simple search term, for example, *skidoos*, *computers*, and *hockey*. In one of the Think Afters in Search Session 2, Dave and I had a discussion about print encyclopedias. We talked about what volume he would select to find out information. After that discussion, Dave used simple search terms and was much more successful locating information. He even said he was thinking about "P" as the volume where he would find information about the origin of the word pharaoh.

All of the participants seemed more confident using the CD-ROM encyclopedias over time. During Search Session 1, most of the participants asked questions about navigation, for example, "What do I press?", "How do I go back?", and, "How do I start again?". By Search Session 2, participants were no longer asking those kinds of questions. They moved confidently through the CD-ROM encyclopedias and remembered things about each one. During Search Session 2 and Search Session 3, some participants began to explore other features, search by word in 1999 World Book (Deluxe), and move back and forth from article outlines, articles, search box and retrieved lists with ease.

5.12.3 Factors Influencing Information-seeking Processes

At the end of the research study in Inuvik, there was some expectation that experiential and cultural factors would prove to be factors in the differences between the information-seeking processes of the participants. However, no differences in the information-seeking processes of the participants were observed. Yet, there were factors that the researcher and the key informants felt may influence searching success.

Ms. A., one of the key informants, identified one factor when she said that her success at searching was dependent on "finding the right keyword." Participants needed to be able to type in a search term that would give them a list of topics. Sometimes one word was a good choice, for example, *cardinal*, other times it was not, for example, *Alaska* or *space*. They also needed to be able to generate other search terms if the first one was unsuccessful. Mr. I. talked about knowing when to "type in exactly what you want" and when to "back up in [his] head to a more general idea to find [his] answer." Ms. B. talked about those students who could not or would not "narrow their search term". They were the ones who typed in *Holocaust* as a search term in AltaVista and found too many articles. Ms. A. talked about the student who came to the library looking for a information on a certain kind of formula and typed in *Chemistry* and was very frustrated with the vast number of webpages the term retrieved.

Ms. B talked about another factor in her interview. She said that she "just did not have time this year to search". Mr. I. also talked about time in his interview. Some participants had a sense of how much time it should take to find the answer. If the answer was not found within that amount of time, then they became frustrated. The amount of time varied by participant with some becoming frustrated if the initial search term did not locate the answer, while other students were much more patient. Patience and perseverance were used by all of the key informants when talking about factors affecting search success. Ms. A. mentioned that some of the weakest students have "all the patience in the world when using a computer". Ms. B. stated that the students want "instant gratification." She sees that "as soon as the list comes up, [the kids] expect it to be the right answer." Mr. I. said that he became frustrated after about 20 minutes of searching. Ms. B. and Ms. A both commented on becoming frustrated after about ten minutes of unsuccessful searching. Ms. B. said, "there are very few times when I have been able to find what I was looking for on the Internet". The amount of time and patience with searching is a very individual thing.

Mr. I. and Mrs. K. talked about previous computer experience as a factor affecting information-seeking processes. Mr. I said, "those students who have computers at home are more independent". Ms. B. noticed that "the boys may have better technical skills." I also noticed that those students who had Internet access at home were more comfortable navigating in the CD-ROM encyclopedias. Eric and Lynn were the most comfortable with the mouse, the keyboard and the navigation tools. Mr I. summed it up when he said, "the more they get to use it [computer], the more success they have, and, therefore, the more they want to use it." Mrs. K. has not noticed an improvement in the skills the grade seven students have when they come to junior high. She still sees the "haves and have nots." However, Ms. B. has noticed that when she gets the students in grade eight, they have good skills. She attributed this to "Mr. I and Mrs. K. and the good work they do with the grade seven students."

In my opinion, Ms. A. stated one of the most important factors. She said, "the kids that are most successful ask questions instead of just fumbling through." I found that the participants who asked questions while searching used that new information in the later searches. Ms. A. commented that many students come to the library "and don't know where to begin. They don't understand what the project is and don't want to ask." She often sees kids "just staring off in space". Mr. I. commented that at the start of grade seven they have lots of questions and it is overwhelming. However, by the end of grade 7 he said, "I am just putting out small fires."

Reading ability was another important factor mentioned by all key informants. Ms. A. stated that some of the students are "intimidated by research stuff and the things that they have to read because of their low literacy skills." Ms. B. said, "reading plays a big part." Some of the students can read but "don't take the time to look at what comes up." Ms. A. said that she "often intervenes and tries to find something at their reading level." Unfortunately, this is often a book rather than a website or CD-ROM encyclopedia article. Those participants with low literacy levels and a small vocabulary had trouble with their searches. They often went to irrelevant articles, for example, Angor Wat from space, league expansion, because they could not read or comprehend the topic. They also seemed to read more of each article, perhaps because they may be unable to skim and scan.

Participants who used skimming and scanning skills to help them with their search were more successful. Several participants made comments in the Think Alouds that demonstrated these skills. They scanned the text following the highlighted words. They looked for a name, for example, a woman's name, or a date, for example, 1996, or a number, for example, 29 546, depending on the question. They used the article outline more effectively than those participants who had low literacy skills did.

Sometimes these participants were unable to understand what they were reading. These participants were more patient than many of the other participants when trying to find information. It suggests to me that they may be used to needing more time to find the answer. The notion of instant gratification is foreign to them because finding answers and reading has always been difficult. Dave and Abby did become frustrated after about ten minutes of searching. On the other hand, Fran, Lynn and Sue, who are good readers, became frustrated after a couple of minutes of unsuccessful searching.

Those participants who understood the differences between an encyclopedia and the Internet were able to generate better initial search terms. Some of the participants expected the encyclopedia to be able to interpret whatever they entered as an initial search term. Very few of the participants understood what full-text searching means. A few came to understand what kind of search terms worked best in each of the encyclopedias as the search sessions progressed. For others, they never really seemed to understand why one encyclopedia worked "better" than the other did. Several of the participants experimented with the search by word feature in 1999 World Book (Deluxe) and I showed them how to change from sentence to article full-text searching. Yet, I still don't think that most of those participants were able to understand how the full-text searching worked.

None of the key informants noticed a gender difference in searching ability and success. Mr. I. suggested that the "girls are more mature and have more perseverance than the boys". Ms. B said that "some of the boys know more technical things but there are girls who are equally well-equipped." Mrs. K. has not noticed a gender difference in the past five years. She admitted that when she first started teaching junior high computers, the boys were more familiar with the technology. Now she said, "they come with the same range of skills whether male or female." I also did not notice a gender difference.

Ms. A. noticed that "more grade 7 students use the computers in the library than the grade 8s or 9s." Mrs. K. noted that "90% of the students love using the computers but 10% absolutely hate them." Ms. A noted that "some of the grade 9s hate to use it." Ms. B. said, "one of my brightest students last year didn't like the Internet, she would rather use a book." Several of the participants were unsure about using the computer. Carol admitted that she did not know how to use one. Abby was also a little hesitant. Even Eric who is very familiar with computers felt a little uncertain about using CD-ROM encyclopedias.

The preceding are some of the factors that participants, key informants and the researcher believed influenced the information-seeking processes of junior high students as they searched for information using CD-ROM encyclopedias. Of them, reading ability, ability to generate good search terms, asking questions, persistence, and experience using computers seem to be the most important.

5.13 Chapter Summary

This chapter described the participant's search terms and information-seeking processes during Search Sessions 1, 2 and 3. The average amount of time needed to answer the questions in Search Session 1 was 5 ½ minutes. Participants used a variety of search terms and many had navigation problems. All twelve participants were able to locate the answers to the four questions in search session one although the amount of time needed to find the answer varied from participant to participant and from question to question. Several of the participants became frustrated. Navigation within the CD-ROM encyclopedias was a frustrating problem during the first searches. The participants struggled with article outlines and list of topics. They had trouble clicking back and several times became lost or ended up back at the initial search page. Some of the participants used huge strings of terms together to try to locate the answer. This worked better in Microsoft Encarta Encyclopedia Deluxe 2000 because it searches for the terms by article while 1999 World Book (Deluxe) searches by sentence in the default mode. Microsoft Encarta Encyclopedia Deluxe 2000 has stop words that it doesn't search for, for example, *who was the first woman in space* becomes *first woman space*.

In Search Session 2, the grade seven participants found the answer to the questions in just over 4 minutes, the grade eight participants found the answer to the questions in just over 5 minutes, and the grade nine participants found the answer to the question in just under 4 minutes. The mean time for all three grades was just about 4 minutes. The participants moved through the encyclopedias purposefully during Search Session 2. For the most part, they just jumped right in and were willing to make adjustments to search terms as needed. Participants discovered that simple search terms were the most effective way of finding the answers to the questions during Search Session 2. It also became apparent that background knowledge can help when searching for questions about countries, rivers and geography.

In Search Session 3, all of the participants generated questions that were important to their personal lives and interests. Most of the questions were ones that could be found in an encyclopedia. Abby spent the most amount of time finding the answers to her questions while Eric and Lynn spent the least amount of time. The mean amount of time needed to answer their self-generated questions was just over 6 minutes. Search Session 3 provided some very interesting approaches to information seeking on CD-ROM encyclopedias

Eric used natural language sentences when searching for most of his answers. Paul continued to be interested in information in general and was not looking for a specific answer. Fran continued to be easily frustrated when the answer was not found immediately after typing in an initial search term. Carol continued to have difficulty making her way through the large number of retrieved topics. Dave used general topics for search terms as well. Ken used the whole question as an initial search for each of his final questions. Lynn continued to be a very effective searcher. Lynn also enjoyed exploring some of the features of the encyclopedia. Abby chose questions that were very difficult to find in an encyclopedia.

Chris continued to use simple search terms to locate information. Bob had difficulty with one question. The rest of the questions he found easily. He continued to use general search terms to find the answers. Mary found the answers to her first three questions easily. The fourth question was not specific and, therefore, it was difficult for her to find an answer. Instead she just spent time reading about a lot of racecar drivers rather than finding one famous racecar driver. Sue's questions were based on her interest in science and since she was very interested in the topic she spent a lot of time reading about the disintegration of stars and exobiology.

This chapter included some information from the interviews with key informants. The three dissertation questions were discussed in detail. Participants in this study all began their search by typing something into the search box. The search term either retrieved a list of topics or gave the message "no topics found". The later caused some participants to be frustrated or confused. Some of them asked for help in generating a new search term. When the participants retrieved a list of topics, most skimmed through the list looking for a topic that seemed relevant. When they did not find such an article, some of the participants used a top to bottom strategy.

Once in an article, participants either skimmed or read the article depending on its length. Several of the participants used highlighted terms as a guide to locate the answers. Once in the appropriate article, the participants usually found the answer. The participants tended to perform three main processes. They entered search terms, skimmed through the list of retrieved topics to find a relevant article, and read, skimmed or scanned through article outlines and articles to find the answer. The information-seeking processes were the same over the three search sessions. Navigation and confidence improved over time.

Using information from key informants, participants and the observations of the researcher, factors that influenced the information-seeking processes of junior high students were presented. These factors included such things as finding the right key word or phrase, knowing when to narrow or broaden the search term, having time, patience and persistence when searching. Other factors included previous computer experience, asking questions of others, reading ability, skimming and scanning skills, and having an understanding of information contained on a CD-ROM encyclopedia.

CHAPTER 6

DISCUSSION

6.1 Introduction

This chapter will discuss the connections between the research literature and the findings from this study. To begin, there will be a brief look at *Information Power: Building Partnerships for Learning* (AASL/AECT, 1998) and two of the Nine Information Literacy Standards for Student Learning. A discussion of the information-seeking theory models and how they relate to this research will follow. Next, information seeking in electronic environments research will be compared, contrasted and extended with the findings from this study. A brief discussion of schema and mental models will follow. The chapter will then examine the reading in electronic environments research in relation to this study. The next section of the chapter will discuss the Think Aloud method and the problems encountered in the research. The chapter concludes with a look at children and adolescents as information seekers.

6.2 Information Literacy

In the vision chapter of *Information Power*, the authors state that,

> Contemporary learning theory describes the student as an active and engaged information user and underscores the importance of students' developing information expertise. Cognitive psychologists define learning itself as the active building of knowledge through dynamic interaction with information and expertise. Theorists in the information field contend that the information search process mirrors this description of the learning process: students actively seek to construct meaning form the sources they encounter and to create products that shape and communicate that meaning effectively. Core elements in both learning and information theory thus converge to suggest that developing expertise in accessing,

> evaluating, and using information is in fact the authentic learning that modern education seeks to promote. (AASL/AECT, 1998, p. 2).

Information Power presents nine information literacy standards for student learning. One and four are directly important to this study. They are:

> Standard 1: The student who is information literate accesses information efficiently and effectively.
> Standard 4: The student who is an independent learner is information literate and pursues information related to personal interests. (p. 8).

The first standard deals directly with accessing information and the fourth with pursuing information for personal interests. This study involved students accessing information from CD-ROM encyclopedias for researcher-generated, teacher-generated and self-generated questions. These three types of questions were asked in an attempt to represent the continuum of information problems that a student might have in a junior high school. The first questions were ones where the participant was expected to have little background knowledge about a topic. The teacher-generated questions were ones that participants would be expected to find information about in their day-to-day schoolwork. The self-generated questions match up with Standard 4 from *Information Power*. The questions the participants developed were ones that related to their personal interests and experiences.

The findings from this study indicate that some junior high students have not developed the skills to access information efficiently and effectively. The amount of time needed to find the answers to questions varied from under a minute to over twenty minutes. Specific skills need to be taught if the students are going to become more effective and efficient. The work of Gross (1999) found that as students get older they search for imposed queries much more often than self-generated queries. Teachers and teacher-librarians need to rethink assignments so that they allow for student choice. Information seeking for personal use should not decrease as students get older.

6.3 Information-seeking Theory

It is important to look at the work of Bates, Kuhlthau (1991), and Tenopir et al. in relation to this study and its findings. Bates' "berrypicking" model is an interesting one for this researcher. Her work presented the notion of an "evolving search." For Bates, the searcher's query changes over time as bits and pieces of information are gathered. Searchers are "not just modifying the search terms in order to get a better match for a single query (p. 410)." It would seem that this "berrypicking" model is especially true in manual searches of print and electronic resources in a library and also on the Internet. But it seems that it is also true in electronic resources such as CD-ROM encyclopedias. Participants in this study typed in initial search terms for every question. Yet, finding no topics or locating too many topics sometimes required a participant to type in another search term. These search terms were often generated because of the nature of the topic list or because the participant reworked, clarified or rephrased the initial query. This created a new query, based on some piece of new information.

Bates suggests that berrypicking "involves the use of a wide variety of techniques, some of which are very standard and others which involve a considerable amount of browsing (p. 415). The important thing to remember is that people use a variety of different techniques. For Bates, these included footnote chasing, citation searching, using key design features of the system, browsing, journal run (looking through a journal manually), area scanning (using a library classification scheme to look at books within a certain location), searching in indexes and bibliographies.

For the participants in this study, the berrypicking techniques were different. The options are limited compared to searching in a library but the participants did indeed use a variety of different techniques. The students browsed, used the key features of search by word and search by topic, used the electronic world atlas feature, tried related articles, asked questions of the researcher, looked at animations and pictures, scrolled through photographs of dogs, etc.

Kuhlthau's Information Search Process (ISP) (1991) which is "the user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem or topic (p. 361)" is important to this discussion. Kuhlthau's work has had a profound effect on the field of library and information science and on this researcher. Her initial work involved high school students as participants.

The ISP is a "big picture" model with information-seeking in CD-ROM encyclopedias being only a very small part. It is the affective part of this model and the concern for the feelings common to each stage of the ISP that really appeared to hold true in this study. Participants in this study indicated, in the Think Alouds and Think Afters, that they initially were quite uncertain about searching the CD-ROM encyclopedias. Near the end of the search session, they were beginning to feel more confident, even when some of the searches were quite complex. Their confidence improved over the next two search sessions.

Within each search, the participants' feelings also followed the ISP. Participants began with some uncertainty after hearing the question. They asked the researcher for clarification if needed. They typed in their initial search term with some optimism. When the term located topics that were appropriate and relevant, participants felt a sense of direction and confidence to continue searching for the answer within an article. The Think Alouds and Think Afters recorded this confidence.

During Paul's last search in Search Session 1, he typed in *boxer* as his initial search term. In the Think Aloud he said, "It is going to have lots of things in it." He was expressing his confidence in the search term and the CD-ROM encyclopedia. In the Think After, Paul stated, "So I went to boxer so I could check if there was boxers or boxer dog because I knew it would be in there." At the end of Paul's second search session in the Think After he stated, "I felt good this time." At the end of Search Session 1, Fran stated, "Oh. This is too easy." In Search Session 3, Fran commented, "We are not going anywhere until I find it." She was quite confident at that point that she would indeed be able to find it.

By the third search in Search Session 1, Carol was beginning to express some confidence. While planning her search, she stated, "It should be in space travel." Carol feels confident enough in the third search session to comment, "I think the other one (CD-ROM encyclopedia) will be easier." Dave experienced difficulties with some of his searches but felt that his final search session was a "good searching day." Ken found Search Session 2 to be "easier this time." Chris commented that he was feeling "a little" more comfortable during Search Session 2. At the end of Search Session 2, Eric confirmed that he felt a little tentative during Search Session 1. He said, "Encarta we have but I do not use it that much." Bob also started feeling more confident during Search Session 2.

On the other hand, when the initial search term failed to give the participant the topics and articles they were hoping for the participant became confused and/or frustrated. The Think Alouds provided a record of these comments.

Fran expressed a lot of emotion during the three search sessions. Sometimes it was confidence and excitement when she located an answer. Other times it was confusion and frustration. In Fran's search session 1, she expressed her frustration in several comments such as "Can you give me a hint?," "Ever bomber.," "They should have them in alphabetical order.," "So why am I looking in here.," and "Oh no!"

Lynn found searching for the first man in space question to be quite "frustrating." She typed in *space, first woman* in Microsoft Encarta Encyclopedia Deluxe 2000 and located the answer right away but using *space, first man* in 1999 World Book (Deluxe) located no topics. Chris was frustrated during a search during Search Session 3. He stated, "Is that as far as it goes? It doesn't say anything." Bob commented that when faced with a huge list of topics it is "too frustrating." After finding the first man in space, Bob said, "It took a little longer than I thought."

The affective part of Kuhlthau's ISP model held true over the three search sessions, that is, as the three search sessions progress the participants moved from being uncertain to feeling relieved and satisfied by the end of Search Session 3. It also held true within more complex searches. For example, Chris' first search was quite complex. The uncertainty stage could be seen in the beginning of his Think Aloud.

> In Space? Oh, in space. Oh. Um. Okay I gotta think here. I am thinking what it would be under. It wouldn't be under space 'cause there is just space. Um. Gotta think. No not under space technology. Oh god. Sometimes I ask what it would be under so it is kinda hard right now. What's that word? Would it be under space geographers? Ooops. That's it? No, nothing there, hm. And I went to astronaut. Should I put man or woman, people? Um, Spacecraft. Nothing up there.

The next section of Chris' Think Aloud showed he was becoming more optimistic once he located an article.

> Would that be it? Or? (points to Mae Jemison) No. She was travelling in space. You said the first woman to travel in space, right? Oh, okay. I see. First African-American woman. In space.

When he saw that Mae Jemison was not the first woman in space, Chris became confused and frustrated. There were several times he sighed loudly in the next part of the Think Aloud.

> I'm keeping on going down. Um. Neil Armstrong. What do astronauts do? Astronaut selection. Was she a … Oh, okay. She was white? Okay. Could be, let's just check it out. (clicked on United States) Oh that's all about the United States. What's up here? I am going to go down I think. Oh. (picture of group of astronauts) Oh they are all men. Let's see, still

> going down. I guess I can't be an astronaut then. You have to have 20/20 vision. Twenty-one men, nothing about women.

Then he had an idea that seemed to bring some clarity to the search.

> Oh. I have an idea. Oops. (types in first people in space) That's a little bit more different. Is that her? Okay, Boris, shuttle docks, Nixon's something address, first people. Okay let's try that. (clicks on astronauts) Same thing I had before isn't it. That's a weird looking, that's weird, that's not real is it?

With the clarity came a sense of direction as he worked his way to an appropriate search term.

> Holy cow. (types in first woman in space) First woman in space. Woman, that is how you spell it, right? Okay. It might be one of these. Now can I ask you if this is right? If that's her name?

After finding the answer, Chris expressed both relief and satisfaction that the search was over.

There were other examples of participants who followed the model during the more complex searches. During the uncertainty stage, the following comments were heard in the Think Alouds:

> What am I supposed to press?
> So if I wrote like space, first woman would that find anything? Which way?
> Do you have to go search now?
> That should be as hard as this one.
> This is a long article.
> Okay, what did I do last time?
> Watch me go all the way through again. Ever bomber!
> Could you just help me? It's so hard finding these bomber space stuff.
> See how long.
> Can I search again?

Some of the participants would sit thinking determining which search term to type in. Then, in the optimism stage, participants type in their search term. The participants made comments such as,

> I am going to go to astronauts. It tells you about space. It tells you about shuttles.
> So I go to birds, yeah, or cardinals.
> I know what. Back. You are gonna be so surprised.
> It should be in space travel.
> Okay. Alaska. I am going to check this first.

After typing in a search term, participants were either able to locate the answer quite quickly from the topics given or experienced confusion, frustration and doubt. In the Think Alouds, participants commented on these feelings.

> Do I hit go now or what?
> Nothing right now.
> I don't know.
> That none of these will work, probably.
> I don't know because …
> Do I read all this?
> No topics found. We are going to have to try something else, right?
> How long should I read?
> It doesn't give you any…
> Is it on here? Did you already look it up?
> Can you give me a hint?
> That's not easy. What is it?
> It doesn't show anything on here.
> Which way?

After finding a new approach that they though might be successful, the participants seemed to have a sense of clarity. They made comments like the following:

> Some of the same ones came up. I am going to go see this one.
> If it was the first man on the moon, it might be the first man in space.
> It is going to have lots of things in it.
> I seen Alaska's pipeline so I remembered that.
> I'll just go back and check.
> I want to go to today's horror films.
> That's where I have to go.
> I seen that. I seen that.
> I am going to check for names.

If the search term provided a list of topics that seemed appropriate, the participants had a sense of direction and confidence. This was especially true of the self-generated search questions.

> So we are getting kind of close.
> It should be in there.
> Let's have a check.
> 1994… so we are getting close.
> I don't know if it is in here, it should be.
> It should be in here.
> I know lots about vampires.

If they were able to find the correct answer, there was a sense of relief and satisfaction. The following comments come from the Think Alouds:

> Found it.
> Boxer dog. Right there. Got it.
> That took a long time.
> Ah, right here, boxer. Told you.
> This is too easy.
> Oh yeah!

In the few cases where students were unable to locate the answer, there was a sense of disappointment. There was also a sense of disappointment when the encyclopedias did not give the kind of detail the participant was hoping for.

Searching on CD-ROM encyclopedias brought out many feelings in the participants. These feelings seemed to match Kuhlthau's ISP model. The other parts of the model do not apply to the information-seeking processes of junior high students as they search CD-ROM encyclopedias. Kuhlthau's model applies to searchers who are working on a larger, more complex project than fact-based searches.

The work of Gross and her imposed query model looked at the circulation transactions in three elementary school libraries. She found that feelings and beliefs between imposer, agent, and intermediary can affect the process. In this study, I acted as the imposer and as the intermediary, helping when the participant encountered difficulties or had questions. As seen in the above description of Kuhlthau's work, the feelings of participants were very much a part of the information-seeking processes.

It is the work of Tenopir, Nahl-Jakobovits, and Howard that more closely fits with the findings from this study. The researchers studied academic users as they searched a magazine database. Tenopir et al. stated that "searchers are involved in dynamic processes at every stop in the search "(p. 252). The researchers described search behaviour as "a voluntary goal-directed and problem-solving activity occurring within three coordinated domains of human behaviour: the affective domain controlling *goal selection* within search tasks; the cognitive domain determining the *strategies* necessary to reach goals; and the sensorimotor domain implementing the necessary *physical actions* to reach goals (p. 253). After the analysis, Tenopir et al. presented the following basic cycle of search behaviour:

1. Setting Goal (Affective)
2. Seeking Assistance (Affective)
3. Obeying Instructions (Affective)
4. Representing Instructions to Self (Cognitive)
5. Memorizing Instructions (Cognitive)
6. Rehearsing Instructions (Cognitive)
7. Executing Instructions (Sensorimotor)
8. Observing Consequences (Sensorimotor)
9. Interpreting Consequences (Cognitive)
10. Reacting to Change in Relation to Goal (Affective)
11. Emoting to Result (Affective)
12. Setting New Subgoal (Affective). (p. 253)

The researchers found that the cycle can recur several times in a single search.

This basic cycle of search behaviour seems to fit well with the data collected in this study. The methods of observations, video tape analysis, Think Alouds, and Think Afters from this research correspond to the pre- and post-interviews, downloaded searches, and "reactions, assessments, and comments of the searchers as they searched" from Tenopir, et al. The researchers also used a small number of participants (3) and focused in depth on these searchers.

Chapter five provides an overview of the approximately 140 searches. When looking at the searches as a whole and also individually, it became apparent that although participants used a wide variety of strategies, the searches tended to follow a cycle like that of Tenopir et al.

Since the first eight questions were researcher- or teacher-generated, the participants were not setting their own goal for the search. The goal was, in fact, set for them. However, in the final search session, students were then able to set their own goals by creating their own search question. Many of the searchers asked questions immediately after the researcher- and/or teacher-generated question was given. These questions were directed to themselves or to the researcher. They were seeking assistance from the system, from their own long term memory or from the teacher-researcher. Comments such as the following were seen in the Think Alouds:

> Who was the first? How do you spell first?
> What am I supposed to press?
> So if I wrote like space, first woman would that find anything?
> Which way?
> I have to type it in there?
> Do you have to go search now?
> There was an earthquake in Alaska?
> Did it just happen recently?
> What is it?

Their next step was to follow the instructions. They went to the appropriate area to search, generated a search term to enter into the system, or listened how to spell the word. The participants then represented the instructions to themselves, memorized the instructions, and rehearsed the instructions. During these steps in the cycle, participants repeated the question or parts of the question over and over to memorize and rehearse. They made comments like the following in the Think Alouds:

> I am thinking I should type population of Alaska in 1996.
> I am going to write down my question.
> I am typing first man in space.
> I am going to go to astronauts. It tells you about space. It tells you about shuttles.
> So I go to birds, yeah, or cardinals.
> It should be in space travel.
> Okay. Alaska. I am going to check this first.

Not all of the participant's Think Alouds record an "inner monologue" of memorizing and rehearsing the instructions. According to Biemiller and Meichenbaum (1998), when a task is automatic it is difficult to talk out loud about it. That does not mean, however, that participants weren't, during the more difficult searches, memorizing and rehearsing.

It just means that they weren't generating Think Aloud data at that time. There were participants, however, who generated detailed Think Alouds following the basic cycle of search behaviour. Several examples will be presented at the end of this discussion. Analysis of the video tapes indicate there were many searches where participants seemed to stop to think before typing in a search term. There was often no Think Aloud data from these thinking times.

To execute instructions, the participants typed in a search term into the search box. Sometimes this was the complete question, sometimes a simple term or phrase and sometimes a Boolean operator was used to join two search terms together. In Microsoft Encarta Encyclopedia Deluxe 2000, the participants typed in the search term and the system began searching immediately. In 1999 World Book (Deluxe), the participants typed in the search term and then had to click either *go* or *search by word*.

After typing in the search term, the participants observed the consequences. The consequences were of three types: no topics found; a relatively few topics found (15 or less); or, many topics found (sometimes more than one or two hundred). The Think Alouds recorded the variety of interpretations of the consequences. Eric commented, "Those won't work." Fran stated, "There's lots." Chris asked, "All of these women are the first women?" Mary questioned, "Is that all?"

Depending on the consequences of the search, the participants reacted to change in relation to their initial question (or goal). Participants had several options in their way to react. They could to decide to click on an article on the list of topics, they could read an article that came up as a result of the search term, they could skim the list of articles, they could decide to try another search term. After reacting to the change, the participants emoted to the result.

It was at this point that participants became disappointed, confused, frustrated, doubtful, relieved, or satisfied (see Kuhlthau ISP above). Comments in the Think Alouds during this step included,

> That took a long time.
> Ah, right here, boxer. Told you. This is too easy.
> Oh yeah!
> No topics found. We are going to have to try something else, right?
> How long should I read.
> It doesn't give you any…
> Is it on here?

> Did you already look it up?
> Can you give me a hint?
> That's not easy.
> What is it?
> It doesn't show anything on here.
> Which way?

Either the participants were able to locate an article where they felt they could find the answer or they were unable to locate an answer. Often the participants needed to set a new subgoal. The Think Alouds were full of comments relating to setting a new goal. Sue located a long list of topics after typing in her search term. In her Think Alouds she stated, "I am trying to find out if there's any little clues to find out who the first astronauts in space are." Mary had difficulty finding a country on the equator. At the end of her third or fourth search cycle, she said, "Areas near the equator. This one?" She sets her new subgoal of looking at an article entitled "areas near the equator" and then seeks assistance, beginning the cycle again. Bob, the end of his second search cycle, stated, "Let's see if they have any topics under space."

Abby did not generate a lot of Think Aloud data. However, analysis of the video tape of her searches shows that after finding a very long list after typing in the word *story*, she added the word *scary* to her search term to create *scary story*. She then tried *scary* and clicked on the Halloween article. Lynn was quick to try new search terms after locating no topics, too many topics or irrelevant topics.

It is interesting to look at the Think Aloud data of a complete search. Chris went through several research cycles before locating the answer to the question, name a country on the equator. The Think Aloud data did not show each individual step in the research cycle. However, in the Think Aloud, all of the steps are visible at one time or another. Analysis of the video tape and the Think After data also show other steps. Chris' Think Aloud was selected because he had the most complete verbal data. Step One in the basic search cycle involves setting the goal, in this case it was to find a country on the equator. The next three steps, seeking assistance, obeying instructions, and representing instructions to self can be seen in the following piece of transcript:

> I think it goes through Africa.
> Oh, okay. Countries. (typed in countries)
> That is how you spell countries, right?

At this point Chris has now memorized, rehearsed and executed the instructions by typing in *countries in Africa*.

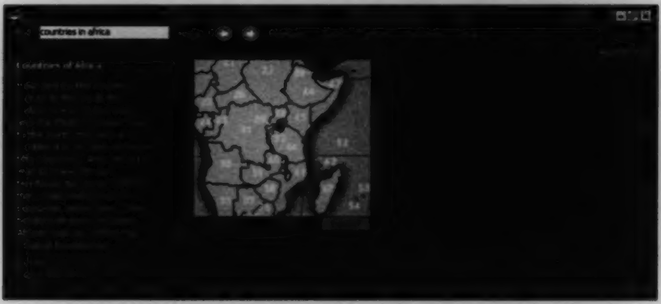
> Okay. Countries of Africa. Oh.

In response to his search term, Chris observed and interpreted the consequences.

> Um. Change that. It should show a picture of the world, right? World picture. Where was that thing? (types world) Maybe its through Africa not Africa though. (clicked on countries of Africa) (Africa came up). (clicking on map of Africa) Number 44, how can I look at that?

He reacted to the change in goal, that is, he wanted the name of a country not just the number given on the map.

Figure 79: Countries of Africa Map in Microsoft Encarta Encyclopedia Deluxe 2000



Chris then set a new subgoal and sought assistance once again.

> Okay, now what was I looking for again?
> Oh right. Africa. (types in Africa) (mumbling) Can I put African? Maybe… A-F-R-I-C… (typed in African countries) (big list) Oops… Oh… How can I get a picture of the world? (mumbling)(went to map) (clicked on map) (skimming article outline) (looking at types of maps across the top of the screen)
> Yeah.

Chris begins the cycle of search behaviour again. He represented the instructions to himself, memorized, rehearsed and executed a new search. After observing and interpreting the consequences, he once again reacted to the change and asked for assistance after setting a new subgoal. The cycle continued again as he searched using the term *map*.

> This won't tell me what's the… That might. (clicked on projection map – countries not labeled and equator not labeled) There is a place that is on the equator but I don't remember where it is. (clicked back to map) (clicked on topographic map) Oh no, same thing. (clicked back) (clicked on types of maps) Oh, I have an idea. I'm not sure if that'll work. (clicked back to countries of Africa map) How can I see what these countries are?

After returning to the map of Africa, he sought assistance trying to find a new way to find the answer.

> Um.
> (deleted countries) (typed in African countries)
> I need a country. I have to go up more. (looking at map) Is it Asia?
> It isn't. Are these countries?
> Introduction.
> Mumbling.
> Yup. Oh. (types in equator) (clicked on Africa) Is that the same thing?

After typing in *equator* as a new search term, he once again observed the consequences and reacted to the change in relation to the goal. He started the search cycle again by seeking assistance.

> Is it Tusinia?
> (types in Tunisia) Ah, there we go. That is better, much much better. I got to go down, but how?

He emoted to the result of finding a country that was in Africa. Then he set a new goal of trying several of the countries near Tunisia using the map.

> Is it Namibia? Sahara. Algeria.
> Over there.
> I thought it was around here.
> (Mumbling)
> Hmm. That is exactly the way I want to do.
> Ummm.

> Is this Africa or is this Africa?
> That's Africa. Okay. I don't know any African countries. Africa countries. I don't know any countries in Africa. That's why I was trying different ones in order to uh (clicking down alphabetical list of places and zooming around the world)

His new subgoal was to use the world atlas to click on alphabetical list of places until he found one that was near to country 44 on the map of Africa.

> How do I spell that? (typed Tunisia)
> That is on the other side. (Taiwan)
> (mumbling)
> That's a big spot. (Russia) (Saudi Arabia) (checking nearby) (St. Vincent) (Italy) (The Bahamas) (Kenya)
> Oh, that looks pretty low.
> Is it Kenya?
> (types in Kenya) Ken Griffey Jr.
> Yeah.
> Ooh. I wonder what this symbolizes. (looking at flag) Do you want to listen to it? Or will it work? Of course it won't. (national anthem)
> Natural regions. I am going to look up here some. There we go. That is Kenya.

He continued through several more research cycles and many of the steps can be seen before he finally located the answer.

Lynn's search for the cardinal shows a single research cycle. Again, not all steps in the research cycle were found in the Think Aloud data but many of them were including: seeking assistance; rehearsing instructions; observing consequences; interpreting consequences; reacting to change in relation to goal; and, emoting to result.

> A cardinal.
> I don't know if this is going to work but I will try it again. (types in bird, cardinal) So just the appearance?
> Okay.
> Is this a picture?
> It gives the sound or something.
> Cool.
> So is that all you need?

About the cardinal?
It's red. I'll just click on this again. (see caption)

Each step in the Tenopir, Nahl-Jakobovits, and Howard (1991) research cycle was located many times in the Think Alouds, Think Afters and video tapes. Some searches showed all steps; others showed only one or two. Yet, looking at the all of the data indicated that, indeed, the participants were going through research cycles as they searched for information using CD-ROM encyclopedias.

The work of Bates, Kuhlthau, and Tenopir et al. continues to be very important to the study of information-seeking processes. For this study, the models and theories presented by these researchers provide support for the idea that users gather information in a variety of ways using a variety of techniques and strategies. Information-seeking is influenced by the cognitive, affective and sensorimotor processes of the user. The user needs support in all three areas not only from the system itself, but also from others such as peers, parents, teachers and teacher-librarians who work with the user.

6.4 Information-seeking in Electronic Environments

There has been much fine research done in the area of information-seeking in electronic environments. Tenopir et al. presented some other findings from their research, along with the search behaviour cycle. They reported that "searches stuck to search strategies they knew, and had a hard time either thinking of others or following up on the alternative strategies they thought of along the way" (p. 252-253). This held true in this study's findings as well. Participants tended to use the same strategies during all three search sessions. Those participants who used simple search terms continued to do that throughout. Those who used natural language sentences or longer phrases continued to do that. Participants tended to use the article outline consistently or did not use it at all.

Tenopir et al. also suggested that searchers have a "need for knowledgeable assistance in choosing strategies for modifying the search" (p. 254). The researchers came to the conclusion that "novice searchers have a variety of needs involving affective, cognitive, and sensorimotor contact that most current online systems fail to address" (p. 254). This was definitely true in this study. Participants wanted to ask a lot of questions about how to change the search and other ways to try to find the answer. When this information was not provided by the system, they asked the researcher. Participants in this study needed support in all three areas during the three search sessions. Sometimes they needed help with what to push, how to click on a link in an article, or how to access the article outline, sound, a picture, and animation. Sometimes they needed help with understanding the question, thinking of another search term, defining difficult vocabulary, or knowing if they are in the right area. They also needed support when they were lost, frustrated, confused, overwhelmed, and disappointed. Very few of these needs were met by the system itself. Instead, the researcher tried to support these needs while the participants searched.

Marchionini (1989a) did the first study of electronic encyclopedias and novice users (elementary school students). Participants in his study tended to use "natural language queries [and] some subjects actually entered full length questions to the system" (p. 61). This finding held true ten years later in this study. Marchionini noted that "novices assigned considerable intelligence to the system" (p. 61) and the data from this study supports this finding. The work of Liebscher and Marchionini (1988) found that novices often limited their search term to the words found in the question. This finding also held true with this study. Only on the rare occasion did participants use terms other than the ones given in the question.

Much work has been done looking at CD-ROM encyclopedias, print encyclopedias, other reference CD-ROMs and the Internet by Large and his colleagues from McGill University (Large & Beheshti, 2000; Large et al., 1998; Large et al., 1994a, 1994b, 1995, 1996; Large et al. 1999). Findings from comparisons between print and CD-ROM encyclopedias for information retrieval are important for this study. Large et al.(1994a) found that 75% of students were able to retrieve the answer within four minutes. In this study the figure was lower, only 60% of participants were able to locate the answers to the questions in less than four minutes. This does not take into account the final self-generated questions, only the first eight researcher- and teacher-generated questions.

Large, Beheshti, Breuleux, and Renaud (1994a) found that complex searches were seven times slower than simple searches. Simple searches consisted of a single search term while complex searches consisted of four terms. Looking at the researcher-generated questions only, question 1 required an average of 8 minutes, and question 3 required an average of 10 minutes. The simples searches, questions 2 and 4, required 1 ½ minutes and 2 minutes, respectively. In this study complex searches were about 5 times slower than simple searches. The researchers found that "few students encountered great difficulties in negotiating the interface" (p. 511). The same was found to be true in this study. Although some participants took longer than others to find the answers, they were all able to work through the CD-ROM encyclopedias.

Solomon's work on children's information retrieval behaviour in an OPAC presented some interesting findings in relation to this study. Solomon found that "younger children seemed to seek assistance from anyone within hearing range [while] older children, especially sixth graders, seemed unwilling to let others know of their problems" (p. 254-255). In this study, participants were always seeking assistance from the researcher. Yet, this research was carried out in isolation from the participant's peers. Whether participants would be a free to ask questions in a group setting remains to be seen. It is this researcher's opinion that several of the participants would still feel free to ask questions, while others would refrain from doing so. Chris is one participant who would probably feel free to ask questions. He acknowledged, during his first Think Aloud, that he often asked others when he was confused or needed help.

Solomon identified two types of strategies, planned and reactive, during the course of his research. Planned strategies focused on "user's actions prior to and including the first move of a session" (p. 256). Reactive strategies "represent the user's decision to follow-up one move with another that aims to improve retrieval, recover from some breakdown condition, or reorient the focus of search to some new course" (p. 256). These two types of strategies can also be identified in this research. Thinking back to the work of Tenopir et al., these types of strategies fit into the search behaviour cycle. Planned strategies would include: setting goal; seeking assistance, obeying instructions; representing instructions to self; memorizing instructions; and, rehearsing instructions. The reactive strategies match up with interpreting consequences, reacting to change in relation to goal, emoting to result and setting new subgoal.

Riding and Chambers, in a study looking at the search strategies of university undergraduates in CD-ROM vs. print textbook, found that a wider variety of strategies were used in the CD-ROM. They suggested that the CD-ROM version supported a wider variety of learning styles. Whether this is true in this study can neither be confirmed or denied. It is important to note that only in very few cases were participants unable to locate an answer. Would the participants have been so successful in a print encyclopedia?

Oliver and Oliver, working with twenty-four twelve year old students using the New Grolier Multimedia Encyclopedia found that "each student tended to prefer one strategy over the others" (p. 41) This finding was also true in this research study. Oliver and Oliver also noted that students with more computer experience used more options, features and shortcuts than those with less computer experience. Perzylo and Oliver (1992) found that some searchers did not make effective use of the various multimedia features. Participants such as Chris, Eric, and Bob and Lynn, all with computers at home and lots of computer experience, used more of the features including animation, search by word, and links to related articles.

Trumball, Gay and Mazur found that novices can become disoriented within a hypertext environment such as a CD-ROM encyclopedia. That was not really the case in this study. The most novice computer users did not stray far from the search box, list of topics, article outline and articles themselves. The more experienced computer users used the back button to return to the previous pages and to track their search. Only one participant became disoriented when trying to get back from a link to a related article.

Gross' study of imposed queries in three school libraries, found that "in using resources, students had trouble finding answers when they had to search through a lot of text [and] when the resources did not use the same terminology they were given in class" (p. 513). This proved true in this study as well. The longer the article the more difficulty participants had locating the answer and moving through the text. Participants, for the most part, used search terms from the question. They did not use synonyms or other terms as a starting point in their search. Gross also noted that children had difficulty in determining what a right answer was when dealing with textual information. Participants in this study did not seem to have the skills necessary to determine if an answer seemed to be the correct one. The participants always asked for confirmation after stating an answer. Gross stated that participants in the study reported that children seek help from other classmates who have special skills. Gross calls this "shared information seeking" (p. 520). In this study, the participant and the researcher, in many cases, were involved in shared information seeking. The Think Alouds became much more like Think Togethers.

Hirsh worked with ten fifth-grade children in an Arizona elementary school with extensive computer resources. She was interested in investigating the relevance criteria that the students used while completing a class assignment. The students' class assignment was to research a sports figure. Her research reported that, of the participants in her study, most had Internet access and all had access to a CD-ROM encyclopedia at home. In this study, eight of the participants had computers at home and most used them to play games or do homework. Only three of the eight had Internet access and only four had CD-ROM encyclopedias. Hirsch's participants asked for help from teachers, librarians and peers when searching for information. Several of the participants in this study also reported asking teachers and friends for help. Chris said, "Sometimes I would ask what it would be under so it is kinda hard right now." Several of the participants also asked me for help with their initial search terms.

Hirsh stated that participants "became frustrated when the displayed results did not match what they expected to see" (p. 1270). This was also true in this research study. Many of the participants became frustrated or confused when displayed results were too numerous, irrelevant or when they got no hits. Hirsch also noted that participants in her study "did not make use of advanced search features, and did not use navigation features" (p. 1278). Only a few of the participants in this study used the search by word feature in 1999 World Book (Deluxe), and only with assistance from the researcher. The participants did not use any of the other options in Microsoft Encarta Encyclopedia Deluxe 2000 except the basis search box. Hirsh's findings suggested "that students could benefit from additional training in how to search and navigate electronic resources that they are likely to use" (p. 1278). She also noted that participants did not clearly understand the contents or how to search each of the electronic resources. I also found the same thing in this research study. Several of the participants did not have a clear sense of the contents of 1999 World Book (Deluxe) and Microsoft Encarta Encyclopedia Deluxe 2000.

Fidel et al.'s study of the searching behaviour of eleventh- and twelfth-grade high school students on the Internet presented several findings. The first was that "searching was both a social and academic event" for the students (p. 28). This involved both giving advice and asking questions and was encouraged by the teacher. This was one of the most important finding for me in this study. I was surprised by how much interaction the participants wanted and needed from me. Fidel et al. stated that the "interchanges covered many aspects relating to searching, ranging from technical pointers to tips about searching to interpretations of the questions in the assignment, and all intertwined with social intercommunications, most verbal, typical of students their age" (p. 28). The interactions with the participants in this study were very similar to the interchanges Fidel et al. report.

The participants in this study needed help with search terms, navigation, spelling and vocabulary. They also talked about frustrations, successes, and background experiences. Searching was a very social experience for my participants. While we waited for CD-ROM encyclopedias to load, we talked about the school play, the weather, snowmobiles, hockey, television, music, movies and Halloween. It is interesting to me that much research about information-seeking processes has been done in settings that did not allow participants to interact with others while searching. We must question whether any model of information-seeking behaviour can hold true if it does not account for the interchanges between participant and others during searching. It also suggests to this researcher that future research in information-seeking processes should be studied in natural settings with groups of participants interacting.

Fidel et al. reported several patterns that apply to the findings of this research. The researchers suggested that the students' "purpose was to find lines on the screen that would answer the questions in the assignment" (p. 28). I also noticed this in my research. Participants were looking for the exact answer to be written in the articles and retrieved lists in the encyclopedias, for example, first woman in space, or, origin of the word pharaoh. Fidel et al. also reported that "searching for information involved much clicking and moving swiftly from one site to another" (p. 29). Most participants in this study moved quickly from the retrieved list of topics to articles and back after skimming the article. Several of the participants, those with the lowest reading levels, did not skim and scan as quickly and seemed to spend much more time looking in the article. They also had a harder time determining if a topic was relevant or if an answer might be in the article. This was especially true of Dave and Abby who found searching quite difficult.

Another interesting pattern was that students felt like they could always start a new search when no satisfactory results had been located. Many of the searches in this study required several moves to locate an relevant article. Lynn, Chris, Fran and Eric were quick to start a new search when a search term failed to retrieve an acceptable list of topics. Lynn was very comfortable with this and in several searches typed six or seven different search terms before retrieving a list of topics that she felt was appropriate. Not surprisingly, according to Fidel et al., "students actively and constantly asked for help from the teacher, the librarian, and their classmates" (p. 30). Students tended to ask whomever was closest to them for assistance. Because I was the only other person in the room with the participants, all questions were directed to me. Some of the participants were very comfortable asking a lot of questions and expressing opinions and emotions about the search, for example, Fran, Chris, Paul, and Bob. Others were a little more hesitant to ask me questions.

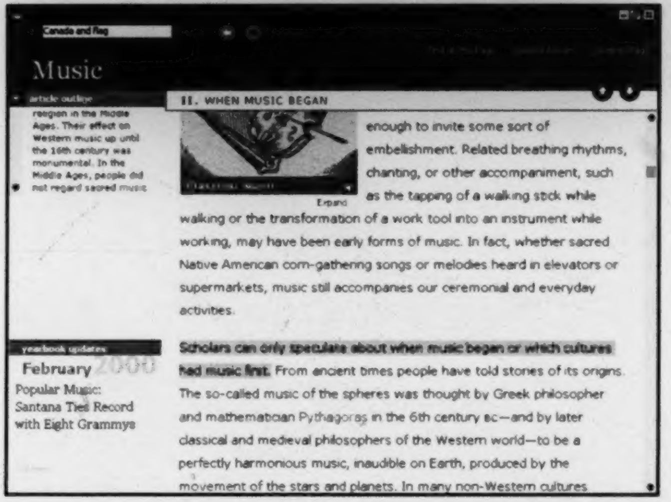
Fidel et al. also reported the students' opinions about the web. For students, the Internet was appealing because of the speed of locating information. I think that participants in this study felt that CD-ROM encyclopedias were appealing for the same reason. Participants were eager to know when their next search session would be and were always glad to come to the research room. Fidel et al. reported that when the Internet failed to produce results quickly, students became frustrated. They were also frustrated when they felt like they had spent a reasonable time and could not locate information. This was very true of this study as well. Participants expected to be able to find the answers quickly. Each seemed to have a "reasonable" time limit in which they expected to find an answer. This was different for different participants. Fran was easily frustrated after one initial search term failed to retrieve an appropriate list while Paul, on the other hand, was much more relaxed about searching. These findings are very interesting when thinking about information literacy instruction. The amount of time spent on a search before a level of frustration reached is very unique. Searchers need skills to deal with the "dead ends" and "huge hit lists" so that they can locate information before they become frustrated. Talking to others while searching, asking questions, and learning new search strategies is one way to help avoid frustration.

Bilal (2000) was interested in the cognitive, physical and affective behaviours of the participants in her study. Her seventh-grade participants were assigned the following question: *How long do alligators live in the wild, and how long in captivity?* In her results, Bilal reported that most of the participants typed in *alligator* or *alligators* as their initial search term. Through the eight searches during Search Session 1 and 2, participants in this study also tended to use simple concepts as initial search terms, for example, Welland Canal, boxer, pharaoh, and, Tropic of Cancer. Bilal also found that "successful children formulated their searches using either single or multiple concepts, whereas unsuccessful ones employed these kinds of concepts in addition to natural language phrases" (p. 656).

Yahooligans! does not support natural language searching. Participants in this study who used natural language phrases, for example, *when was Ramses the second was pharaoh, what a boxer dog looks like*, were much less successful than those participants who used simple search terms, for example, *Ramses II, boxer, history of television*. Microsoft Encarta Encyclopedia Deluxe 2000 does support natural language searching much better than 1999 World Book (Deluxe). This is because 1999 World Book (Deluxe) searches for the words in a sentence by default while Microsoft Encarta Encyclopedia Deluxe 2000 searches for the words in an article by default, that is, in 1999 World Book (Deluxe) *first woman in space* must appear in one sentence while in Microsoft Encarta Encyclopedia Deluxe 2000 *first woman in space* must appear in the article.

Scrolling, use of the back button, and navigating links were three important physical behaviours that all students used when search in Yahooligans!. This was also true in this study when the back button was used by students when they were lost. Participants used the back button more often when using Microsoft Encarta Encyclopedia Deluxe 2000. When participants clicked on a topic, the article completely covered the screen and so to return to the list of hits they had to hit the back button (See Figure 79).

Figure 79: Music Article in Microsoft Encarta Encyclopedia Deluxe 2000



reegion in the Middle Ages. Their effect on Western music up until the 16th century was monumental. In the Middle Ages, people did not regard sacred music

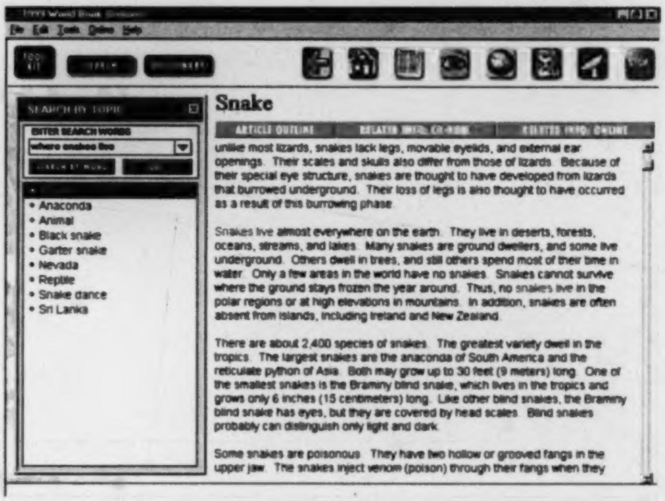
enough to invite some sort of embellishment. Related breathing rhythms, chanting, or other accompaniment, such as the tapping of a walking stick while walking or the transformation of a work tool into an instrument while working, may have been early forms of music. In fact, whether sacred Native American corn-gathering songs or melodies heard in elevators or supermarkets, music still accompanies our ceremonial and everyday activities.

Scholars can only speculate about when music began or which cultures had music first. From ancient times people have told stories of its origins. The so-called music of the spheres was thought by Greek philosopher and mathematician Pythagoras in the 6th century BC—and by later classical and medieval philosophers of the Western world—to be a perfectly harmonious music, inaudible on Earth, produced by the movement of the stars and planets. In many non-Western cultures

Popular Music: Santana Ties Record with Eight Grammys

In 1999 World Book (Deluxe), the list of topics remains on the left side of the screen when the article appears so participants did not need to click on the back button to return to the list (See Figure 80). Only rarely did participants have to use the back button to get out of a table in 1999 World Book (Deluxe) that took over the whole screen, for example, World Cup Championship Games (see Figure 81).

Figure 80: Snake Article in 1999 World Book (Deluxe)



where snakes live

- Anaconda
- Animal
- Black snake
- Garter snake
- Nevada
- Reptile
- Snake dance
- Sri Lanka

Snake

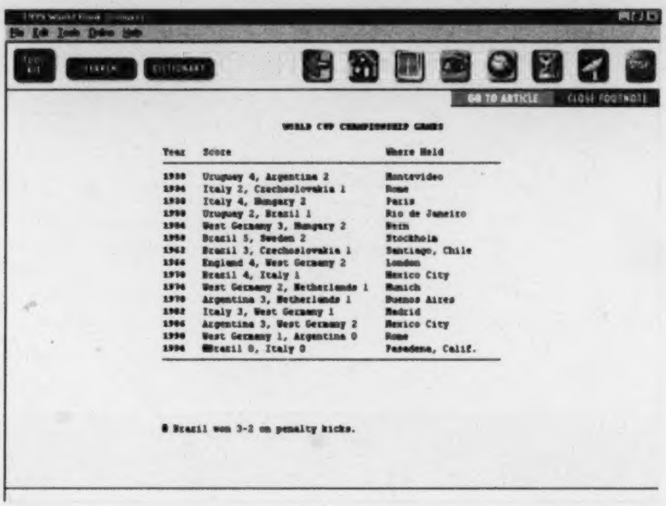
unlike most lizards, snakes lack legs, movable eyelids, and external ear openings. Their scales and skulls also differ from those of lizards. Because of their special eye structure, snakes are thought to have developed from lizards that burrowed underground. Their loss of legs is also thought to have occurred as a result of this burrowing phase.

Snakes live almost everywhere on the earth. They live in deserts, forests, oceans, streams, and lakes. Many snakes are ground dwellers, and some live underground. Others dwell in trees, and still others spend most of their time in water. Only a few areas in the world have no snakes. Snakes cannot survive where the ground stays frozen the year around. Thus, no snakes live in the polar regions or at high elevations in mountains. In addition, snakes are often absent from islands, including Ireland and New Zealand.

There are about 2,400 species of snakes. The greatest variety dwell in the tropics. The largest snakes are the anaconda of South America and the reticulate python of Asia. Both may grow up to 30 feet (9 meters) long. One of the smallest snakes is the Braminy blind snake, which lives in the tropics and grows only 6 inches (15 centimeters) long. Like other blind snakes, the Braminy blind snake has eyes, but they are covered by head scales. Blind snakes probably can distinguish only light and dark.

Some snakes are poisonous. They have two hollow or grooved fangs in the upper jaw. The snakes inject venom (poison) through their fangs when they

Figure 81: World Cup Championship Games from 1999 World Book (Deluxe)



WORLD CUP CHAMPIONSHIP GAMES

Year	Score	Where Held
1930	Uruguay 4, Argentina 2	Montevideo
1934	Italy 2, Czechoslovakia 1	Rome
1938	Italy 4, Hungary 2	Paris
1950	Uruguay 2, Brazil 1	Rio de Janeiro
1954	West Germany 3, Hungary 2	Bern
1958	Brazil 5, Sweden 2	Stockholm
1962	Brazil 3, Czechoslovakia 1	Santiago, Chile
1966	England 4, West Germany 2	London
1970	Brazil 4, Italy 1	Mexico City
1974	West Germany 2, Netherlands 1	Munich
1978	Argentina 3, Netherlands 1	Buenos Aires
1982	Italy 3, West Germany 1	Madrid
1986	Argentina 3, West Germany 2	Mexico City
1990	West Germany 1, Argentina 0	Rome
1994	●Brazil 0, Italy 0	Pasadena, Calif.

● Brazil won 3-2 on penalty kicks.

Bilal reported that "in general, children did not scroll long screens as fully as they did short ones" (p. 655). This was also noticed in this research. Participants did not scroll the large articles such as space, Alaska, and Egypt. With short articles such as cardinal, boxer, Welland Canal, Tropic of Cancer and pharaoh, participants scrolled to the end of each article. Bilal found that "children's domain knowledge, topic knowledge, and reading ability did not significantly influence their success" (p. 659). This was also true in this study. Participants with lower reading abilities did take longer to find the answers in some questions but they were almost always successful.

Heller suggested that "many younger students may not have the intellectual capacity to be able to actively ignore non-essential information as they browse a hypermedia system" (p. 35). This research study suggests that cognitive overload may also occur when trying to generate Think Aloud data while searching. There will be a discussion of the problems that some participants encountered when generating Think Aloud data in a later section within this chapter.

The above studies indicate that many people are very interested in information-seeking in electronic environments. The studies focus on participants of all ages as they interact with CD-ROMs, OPACs, online databases, and the Internet. Many findings from other researchers were supported by the data collected in this study.

6.5 Schema and Mental Models in Electronic Environments

Marchionini and Liebscher studied undergraduates as they searched both print and electronic encyclopedias. The researchers were interested in the relationship between cognitive load, the amount of mental energy needed to perform a certain task, and mental model development. Marchionini and Liebscher believed that "the dual concepts of mental models and cognitive load seem, therefore, to be closely bound" (p. 39). The work of Marchionini and Liebscher suggests that when using CD-ROM encyclopedias "cognitive load has to be given to adapting, developing, and refining their emerging mental models for the electronic search system" (p. 44). This is quite different from the cognitive load needed to access print encyclopedias. They also report that it is the retrieved list of topics received from a full-text electronic encyclopedia that is an "important and critical element in the search process" (p. 44). Some cognitive load must also go to processing the retrieved list. Then, for Marchionini and Liebscher, the rest of the cognitive resources can be used for the search task.

In this study, not only was searching on electronic encyclopedias new for some participants, but they were also asked to Think Aloud while searching. It is not surprising that some participants had difficulties searching, processing retrieved lists of topics, developing a new mental model of the system, and generating Think Alouds, all at the same time. Section 6.7 looks at the problems associated with the Think Alouds generated in this study.

After reviewing the transcripts and videotapes, it became apparent that some students had an incomplete mental model of the electronic encyclopedias. Some had a print encyclopedia mental model and thought about the system like it was 26 volumes placed on a CD-ROM. When we talked in the Think Afters, Fran made the following comments:

> It's so long though. It [CD-ROM encyclopedia] doesn't have it paged like it [print encyclopedia] would. It would have said space, first woman or something like that.

Dave was having difficulty finding answers because he was using the whole question as his initial search term. In the Think Afters during Search Session1, we talked about a print encyclopedia and I asked him what volume he would look in to find information about Yellowknife. He told me "Y." Later, during Search Session 2, I asked him what he was thinking about when he selected Pharaoh as his search term and he said "P." Bob had a print encyclopedia mental model that he brought to the system. He spoke about knowing there would be an article on cardinal "because it is an encyclopedia." He also stated that he would go to "N for Nelson River" and "T for Tropic of Cancer" in a print encyclopedia. Bob used the initial search terms Nelson River and Tropic of Cancer in Search Session 2.

Marchionini and Liebscher found that incomplete mental models allowed users to function adequately. That is true in this study as well. Some of the participants did not appear to have a mental model for electronic encyclopedias at all, did not seem to transfer knowledge of print encyclopedias to electronic encyclopedias, and had no sense of the structure of the CD-ROM encyclopedias whatsoever. They felt it could answer any question with any natural language query. They did not have an understanding of the fact that the information contained on the CD-ROM was made up of all the information in a print encyclopedia plus animation, video and sound. Information from a computer, for example, Internet, databases, and CD-ROM encyclopedias, was all the same for some participants.

The participants had an incomplete mental model for a CD-ROM encyclopedia. Rather, some participants had a mental model about searching for information on computers in general. A new question may be to determine what other mental models may be applied to an electronic encyclopedia when students do not apply a print encyclopedia mental model. It would be interesting to compare searchers with a "print encyclopedia" mental model, an electronic encyclopedia mental model, and a "computer information" mental model. It seems also to be important to flesh out these mental models so that teacher-librarians can help fill in "the gaps" with students.

6.6 Reading in Electronic Environments

The differences between print and computer conventions provide an interesting starting point to consider some of the needs of novice users in developing electronic literacy. Burbules (1998) stated that "reading is a practice, and as such it partakes of the contexts and social relations in which it takes place; significant differences in those contexts and relations alter the practice" (p. 102). Therefore, reading electronically differs from paper-based reading. Selfe argued that the standard rules that govern paper-based texts are different than those on a computer screen.

The study by Anderson-Inman et al. looked at hypertext reading of a short story by students in the middle grades. "A close review of the transcripts resulting from the computer monitors revealed at least six distinctly different ways in which students interacted with (read) the ElectroText versions of existing short stories" (p. 283). They called these hypertext-reading patterns and described them as follows:

> - Skimming: Moving through the text at a pace too fast for reading or studying.
> - Checking: Moving through the text and/or resources systematically, apparently checking things out, but not reading or responding.
> - Reading: Visiting text pages for periods long enough to read the material but with little or no use of the resources.
> - Responding: Accessing resources, but not in a way that appears related to reading the text.
> - Studying: Moving through the text pages systematically, visiting pages long enough to read them, and using resources in an integrated manner.
> - Reviewing: Rereading the text and/or accessing the available resources a second time. (p. 283)

These hypertext-reading patterns were also apparent in CD-ROM encyclopedia searching by the junior high participants. Much skimming and scanning was involved in moving through large articles and large retrieved lists of topics. Several times participants missed the answer to the question because they were skimming at a pace too fast to read. Participants used both the checking and studying patterns when faced with a list of names from the first woman in space question. Eric and Dave both systematically checked out each of the names in alphabetical order from the retrieved list. They did read the first few sentences of the article before clicking back to the list. Much of the time, students were actually reading articles or sections of articles to find the answer. The Think Alouds are full of statements like "I am just reading," "I am reading the article," and "I think the answer is in here," "I am reading to see if the answer is in here."

When students became frustrated or when they were skimming through large articles, some responding patterns were seen. Abby, Dave, Chris and Paul clicked on links that did not seem to involve reading text. Abby looked at a satellite shot of Angor Wat from space and listened to some modern African music. Dave and Paul clicked on pictures that interested them as they scrolled down long articles. Chris was frustrated and clicked on all kinds of strange places from the retrieved list in an effort to locate a country on the equator. The studying pattern was often present during searches. Most of the participants located a relevant article, read it and used picture, animation and sound only when appropriate. The participants tended to be very focused searchers. Only in the very large articles and during the most complex questions, did participants use the reviewing pattern. It was most noticeable in Search Session 1 as participants explored the encyclopedias. In the later search sessions, participants rarely returned to an article for a second time.

Anderson-Inman et al. also identified three types of reading skills that were effective in this specific hypertext environment. They felt that students must have "a mental model of the information in the hypertext document and an understanding of how or why the information is chunked as it is" (p. 285). They called this knowledge of the document structure. The research indicated that adolescents needed to engage the text and its various enhancements with a sense of purpose. Successful hypertext users were able to use available resources at appropriate times when working through the text. The researchers also felt that students required a multiphasic approach to reading. As students worked through the text they needed to make decisions to help increase their comprehension. This research supports the need for these reading skills.

Anderson-Inman et al. also proposed three profiles to describe adolescent reading of fiction in hypertext: Book lovers, Studiers, and Resource Junkies. The participants in this study did not seem to fall completely into any of these three profiles. They were focused on finding the answer to the question. There were no participants who were resource junkies. Rather, they rarely used the other features of the CD-ROM encyclopedias except when the question demanded it.

Slatin also presented three types of hypertext fiction readers. He called them browsers, users and co-authors. Browsers wander through the text and read for pleasure and are unlikely to go through all the material. The user is " a reader with a clear – and often clearly limited – purpose" (p. 875). Users access the system to locate specific information and then leave it. The co-authors become actively involved in the hypertext. These descriptions are much more applicable to the participants in this study. Paul and Lynn were really the only participants who were browsers during all three search sessions. However, some of the participants were browsers during Search Session 3, when they generated their own questions. They enjoyed reading and taking little side trips to new and interesting information. The rest of the of the participants were users. They had a clear and focused purpose for their search and located the information so they could leave it. None of the participants were co-authors. It would be interesting to study the similarities and differences between students who tend to be browsers and students who tend to be users over a long period of time.

Selfe suggested that those raised on print strategies might not be able to generate the most creative strategies necessary for hyperliteracy. As a result, "we may have to turn to our own students for help, observing the literacy strategies they develop on their own for coping within computer-supported communication environments" (p. 7). It will continue to be important to observe our students because they have much to tell us about this new literacy.

6.7 Think Alouds and Think Afters

Think Alouds and Think Afters provided valuable data about the information-seeking processes of the junior high participants. The Think Afters were quite brief compared to the Think Alouds. Much of what the participants wanted to share about the search was given during the Think Alouds. However, there was a wide range in the amount of verbal data generated during the Think Alouds. An example of one participant's Think Aloud follows:

> Jenn: This time I want you to find the first man in space.
> Remember to talk and tell me.
> *I am just putting first man in space.*
> *(No topics found) I clicked okay. (clicked search by word - no topics found) I clicked okay again. I am clicking articles. I am clicking go. (no topics found) I am clicking okay.*
> *(no topics found) Clicking okay.*
> *I'm looking at the picture of the article.*
> *(sitting and thinking)*
> *Typing in man space. (typed in space) Clicking search by word.*
> (Mary, Grade 9 student)

I knew as this search was happening that this participant was having difficulty generating a Think Aloud protocol. It did not happen with every participant but there seemed to be some participants who just could not do a Think Aloud. What was happening? Why were some students so comfortable with Think Alouds? Why were some students able to do the Think Alouds while others barely said a word, even with prompts?

Concurrent verbal protocols are increasingly used as a source of data for process inquiry tasks such as reading, writing and problem solving (Stratman & Hamp-Lyons, 1994). Concurrent verbal protocols should provide a "dramatic increase in the amount of behaviour that can be observed when a subject is performing a task while thinking aloud compared to the same subject working under silent conditions" (Ericsson & Simon, 1993, p. xiii). Yet in this research study, some of the participants had difficulty with Think Alouds. Stratman and Hamp-Lyons call it the "reactivity problem" (p. 90). This is the notion that something can happen when participants are required to do Think Alouds while carrying out a task. They suggest there are five factors that may cause reactivity in concurrent verbal protocols:

> 1. experimental task directions to subjects that elicit an inappropriate level of verbalization;
> 2. limited short-term memory capacity for talking and attending at the same time;
> 3. hearing one's own voice;
> 4. learning that occurs because thinking out loud increases subjects' critical attention to their activities; and
> 5. direct or indirect experimenter influence through verbal or nonverbal cues. (p. 95)

It is the second point that is the most interesting to this researcher. The focus of this section will be the work of Biemiller and Meichebaum and their colleagues working at the University of Toronto and the University of Waterloo, respectively (Biemiller & Meichenbaum, 1992, 1998; Meichenbaum & Biemiller, 1992, 1998). Using part of the coding scheme of Biemiller and Meichenbaum (1992), Think Aloud data from the 140 protocols was coded.

An overview of concurrent verbal protocols can be found in Chapter 2. A brief presentation of recent information-seeking research using the think aloud method is also presented in Chapter 2. It was interesting to note that many of the researchers cited there used the Think Aloud method for data collection, yet none discuss reactivity or any difficulties with the method in generating their data.

The interest of Biemiller & Meichenbaum in the self-directed learner seems, at first, totally incongruous with this work on information-seeking processes and verbal protocol analysis. Yet, on closer study, the researchers are interested in the very same thing – the nature of thinking out loud as one does a task. Their research, conducted over the past 15 years, involved studying students in elementary schools as identified by their teachers and peers as the most and least self-directed. In a study involving 70 high and 70 low self-directed learners, the researchers recorded what the students did and what the students said. This involved recording the students' self-talk, their talk to peers, and their talk to teachers. As a result of this work, Biemiller and Meichenbaum (1992) developed a coding system to analyze the "children's discourse about tasks" (p. 76).

This coding system enabled the researchers to compare high and low self-directed learners and to "infer the nature of their cognitive and metacognitive self-regulatory activities" (p. 76). This task-related speech, or Think Alouds, provided the researcher with a way of accessing the cognitive processes of a learner. Biemiller and Meichenbaum determined that "children whose level of cognitive development exceeds the complexity of tasks they are being taught have "surplus mental capacity" permitting them to "think" (self-dialogue) about what they are doing" (p. 76). On the other hand, children who are less cognitively advanced approached a task with fewer skills. As a result, they encountered an overload or, at the very least, needed their full attention to complete the task. These low self-directed learners had "little or no capacity left for verbal thought processes while conducting the task" (p. 76).

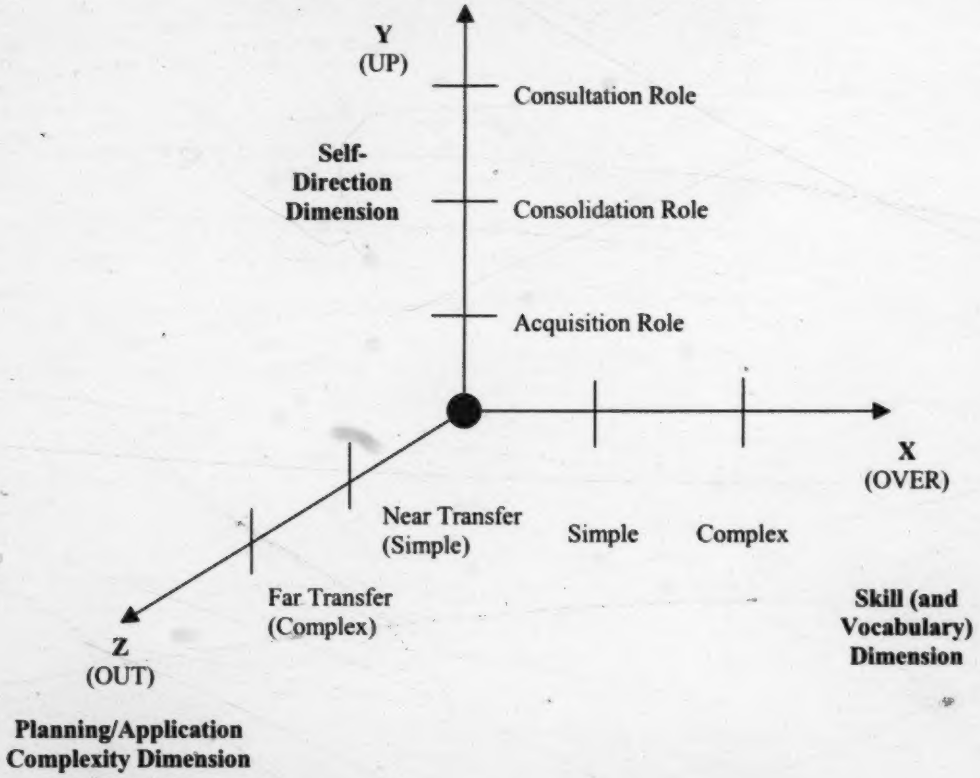
Specifically, Biemiller and Meichenbaum found that highly self-directed learners generated more than twice as many statements as less self-directed learners. The statements were coded as defining, planning, conditional planning, monitoring, or evaluating. The following is an explanation of the coding categories:

> Defining: Statement or question labels and notes features of tasks, procedures, and objects ("It's John's game." "That's red paint.").
> Planning: Statement or question about what will or should happen next ("Can I do X?" "Mix some soap in the paint." " Where are the sparkles?" "I need…").
> Conditional Planning: Statement or question related a plan to a condition or specifies the basis for choosing between alternative plans ("If we make noise, then we won't have recess.").
> Monitoring (ongoing task): Statement or question notes progress, or lack thereof, on the task (You're going too fast." "Slow down.").
> Evaluating (completed or aborted task): Statement or question concerns conclusions on ending the task – regarding the product, the child's ability, or the experience of doing the task ("This is my best one so far!" "I can't do it!" "The math squares are fun!"). (p. 78)

Both groups had similar rates of defining and evaluating statements but highly self-directed learners had more planning and monitoring statements. The authors suggest that "spontaneous planning and monitoring statements are crucial indicators of the degree to which a child is functioning with expertise in a specific situation" (p. 76). Seventeen task-directive statements per hour were received by less self-directed learners from their teachers. Highly self-directed students received only two statements per hour from their teachers. Teachers were "thinking for" the less self-directed learners by giving them planning and monitoring statements (Biemiller & Meichenbaum, 1992).

Meichenbaum and Biemiller (1998), in their book Nurturing Independent Learners: Helping Students Take Charge of Their Learning, present a three-dimensional theory of mastery. The model is located in Figure 82.

Figure 82: The Three Dimensions of Mastery


Y
(UP)
Consultation Role
Self-Direction Dimension
Consolidation Role
Acquisition Role
X
(OVER)
Near Transfer (Simple)
Simple
Complex
Far Transfer (Complex)
Z
(OUT)
Skill (and Vocabulary) Dimension
Planning/Application Complexity Dimension

Source, Meichenbaum, D., & Biemiller, A. (1998).Nurturing independent learners: Helping students take charge of their own learning. Cambridge, MA: Brookline Books, p. 71.

Based on the constructivist model, this theory consists of the Skill and Vocabulary Dimension, the Planning/Application Complexity Dimension and the Self-Direction Dimension. The Skill and Vocabulary Dimension "refers to the level of difficulty or complexity of the skills and concepts required for successful accomplishment of the task" (p. 70). While one goal of instruction is to teach students to perform more difficult tasks, another goal is "to teach students to transfer skills and strategies they have learned to analogous tasks in new situations" (p. 72). The Planning/Application Complexity Dimension refers to this second goal. The third dimension, the Self-Directed Dimension, refers to the range of tasks that a learner encounters. These tasks can "range from being *other-directed* (others guide the learner through the performance of the task on a step-by-step basis), to being *self-directed* (the learner is responsible for all aspects of accomplishing the task)" (p. 75).

Meichenbaum and Biemiller identified "three phases of self-direction: *acquisition*, *consolidation*, and *consultation*. These three phases fall within Vygotsky's Zone of Proximal Development. In the *acquisition* role, the learner "observes, imitates and acts under the guidance of the instructor" (p. 75). In this role, learners are less likely to be able to do the task and to also be able to talk about it at the same time. In the *consolidation* role, the task begins to become more automatic. This automaticity "reduces the attentional and memory load associated with the skill, freeing up cognitive capacity to attend to other features of the task or to talk or think about the task while doing it" (Meichenbaum & Biemiller, 1998, p. 76). In the *consolidation* role, the learner becomes more able to plan and ask questions, and, as a result, becomes more efficient. Learners who have reached the *consultation* role "can perform requisite skills and plan specified applications, provide assistance to others as needed, collaborate effectively with others in planning large tasks, and consult with themselves when they encounter difficulties or problems in accomplishing tasks" (p. 77).

Biemiller and Meichenbaum's work is very interesting, especially when considering the problems that some of the participants in this study appeared to encounter when doing Think Alouds while searching CD-ROM encyclopedias. Stratman and Hamp-Lyons' list of reactivity factors includes "limited short-term memory capacity for talking and attending at the same time" (p. 95). To determine if the *acquisition, consolidation and consultation* roles could be applied to junior high information-seeking processes, the coding scheme developed by Biemiller and Meichenbaum (1992) was used.

While transcribing the Think Aloud protocols, I started to notice that some participants had what I would call incomplete Think Alouds, that is, very brief Think Alouds or very procedural Think Alouds. Some of the participants were not able to generate complete

Think Alouds while performing the task. There has been much written about why this can happen. Stratman and Hamp-Lyons' list of factors is a good one. These include poor Think Aloud directions, limited capacity in short-term memory to do task and Think Aloud, hearing the sound of one's own voice, increase in learning due to Think Alouds, and influence of researcher's verbal and non-verbal cues. It is the notion that some participant's may be unable to do a task and Think Aloud at the same time that is most interesting to this researcher.

The work of Biemiller and Meichenbaum provided one way of looking at the participants in this study and their ability to generate Think Alouds. Using Biemiller and Meichenbaum's (1992) coding scheme for task directive speech, the 144 Think Aloud Protocols were analyzed. This involved coding each statement as defining, planning, monitoring or evaluating. For this coding, planning and conditional planning were combined under the planning task function because only two examples of conditional planning were found after coding all of the Think Alouds. This coding can be seen in Table XXIII.

Table XXIV: Number of Coded Statements by Search Session

Name	Search Session 1					Search Session 2					Search Session 3				
	D	P	M	E	T	D	P	M	E	T	D	P	M	E	T
Eric	40	10	2	0	52	16	1	0	0	17	29	1	0	1	31
Paul	120	7	4	0	131	71	5	3	0	79	132	4	0	1	137
Fran	240	16	10	12	276	39	2	7	1	49	54	6	11	0	71
Carol	42	0	0	0	42	63	2	1	0	66	63	7	4	0	74
Dave	49	2	1	0	52	39	4	0	0	43	27	0	1	0	28
Ken	37	1	1	0	39	23	0	0	0	23	21	1	0	1	23
Lynn	33	2	2	1	38	77	3	5	0	85	43	0	1	1	45
Abby	45	2	0	1	48	38	0	1	1	40	22	1	1	0	24
Chris	159	32	31	6	228	72	12	12	3	99	64	9	11	0	84
Bob	51	9	8	1	69	25	5	5	0	35	29	5	5	1	40
Mary	32	1	0	0	33	21	0	1	0	22	13	0	0	0	13
Sue	20	3	3	1	27	22	1	1	1	25	27	1	0	3	31

The data was coded using coloured stickers to represent each of the five coding categories. A total of 2221 statements were coded from the 140 Think Alouds. This section will report the overall results of the coding during the three search sessions. It will also compare all of the participant's Think Alouds during Search Session 1. Who was the first woman and man in space, questions 1 and 3 in Search Session 1, required quite complex searching. Questions 2 and 4, that is, describe the cardinal, and describe the boxer, were more simple searches. It is interesting to look at the differences between participant's Think Alouds in simple and complex searches. The first table below shows the results of the coding. The tables use the following: D – defining; P – planning; M – monitoring; E – evaluating; and, T – total.

A quick look at the table shows that there was a range in the number of Think Aloud statements in each search session. In Search Sessions 1, 2, and 3 there was a total of 1037, 583, and 601 statements, respectively. In Search Session 1, Fran had 278 statements while Sue had only 27, a difference of 251. In Search Sessions 2 and 3, the range was smaller, 82 and 124, respectively. The first session had many more statements because students had a more difficult time finding the answers to the questions. Also with practice students became more efficient searchers. The mean number of statements decreased from 86.4 in Search Session 1 to 58.6 in Search Session 2 to 50.1 in Search Session 3.

Carol had no planning, monitoring or evaluating statements in her first session but her planning and monitoring statements did increase over time. Fran, Chris, and Bob had planning and monitoring statements in each of the search sessions. Fran and Sue were the only participants with evaluating statements in each search session. Several of the participants made very few planning or monitoring statements during all three of the search sessions. The graph on the next page shows the differences in the number of statements by each participant. The average number of statements was 181. Chris, Paul and Fran generated a lot of Think Aloud data. Other participants such as Sue, Mary, Ken, and Eric generated much fewer statements than the average. Biemiller and Meichenbaum (1992) noted in their research that highly self-directed learners generated more than twice as many statements as less self-directed learners.

It is impossible to compare between grades for Search Session 2 because different questions were asked. Search Session 3 also can not be compared as each participant generated search questions of his/her own. There were participants in each grade who generated a lot of Think Alouds statements and who did not. However, it is interesting to look at Search Session 1. Participants had two very different types of questions. The answer to the first question "Who was the first woman in space?" and the third question "Who was the first man in space?" was complex (See Table XXIV). These questions were chosen because they were quite complex and had more than three search terms.

Table XXV – Number of Statements in Complex Searches (Questions 1 and 3)

Name	First Woman in Space					First Man in Space				
	D	P	M	E	T	D	P	M	E	T
Eric	13	6	2	0	21	20	4	0	0	24
Paul	88	3	3	0	89	8	1	0	0	9
Fran	57	5	3	1	66	102	6	3	7	118
Carol	12	0	0	0	12	15	0	0	0	15
Dave	21	2	1	0	24	12	1	0	0	13
Ken	20	1	1	0	22	7	1	0	0	8
Lynn	4	0	0	0	4	14	2	2	1	19
Abby	23	1	0	1	25	9	1	0	0	10
Chris	43	12	9	1	65	101	18	22	4	145
Bob	9	2	1	0	12	25	3	1	1	30
Mary	6	0	0	0	6	15	0	0	0	15
Sue	3	0	0	0	3	11	2	3	1	17

Four of the participants, Carol, Lynn, Mary and Sue did not have any planning or monitoring statements in the first search. However, the searchers were very different. Carol and Mary are novice searchers and admitted in the initial interview that they didn't know anything about computers. Lynn and Sue, on the other hand, are experienced searchers and found the answers quickly and easily. Explanations for the few planning and monitoring statements can be explained by the work of Biemiller and Meichenbaum (1992). When learners in the acquisition role are faced with a new task it "creates "overload," or at least occupies the student's full attention" (p. 76). Mary and Carol were unable to do the task and also think about it at the same time. Lynn and Sue, on the other hand, were very familiar with the task and searching for an answer was an automatic process; one that needed little self-talk or thought.

Several of the participants had a high number of planning and monitoring statements. These participants, Chris, Bob and Eric, were likely in the consolidation or consultation role. They felt comfortable doing the Think Alouds and generated more planning statements than the group as a whole. They were all familiar with computers, had one at home and spent time searching on the Internet. When searching for the answer to "Who was the first man in space?" a few more of the participants had planning statements. It may not be surprising to note that the boys tended to be more familiar with computers and more able to do some planning and/or monitoring in each search.

Two of the participants had no planning or monitoring statements in either search. Mary and Carol are both novice users and were very quiet during their searches. A piece of

Mary's Think Aloud is included in the introduction to this paper. Although Mary continued to be very quiet during her searches, Carol began to use more planning and monitoring statements as she progressed through the searches. This may indicate a movement from the acquisition role to the consolidation role.

Table XXVI – Number of Statements in Simple Searches (Questions 2 and 4)

Name	Cardinal					Boxer				
	D	P	M	E	T	D	P	M	E	T
Eric	4	0	0	0	4	3	0	0	0	3
Paul	22	2	0	0	24	7	1	1	0	9
Fran	37	5	4	4	50	44	0	0	0	44
Carol	7	0	0	0	7	8	0	0	0	8
Dave	5	0	0	0	5	4	0	0	0	4
Ken	5	0	0	0	5	5	0	0	0	5
Lynn	6	0	0	1	7	9	0	0	0	9
Abby	4	0	0	0	4	9	0	0	0	9
Chris	9	1	0	1	11	6	1	0	0	7
Bob	2	1	1	0	4	15	3	5	0	23
Mary	4	1	0	0	5	7	0	0	0	7
Sue	3	0	0	0	3	3	1	0	0	4

The second and fourth questions were much easier for most participants (See Table XXV). Most of the participants typed in the word cardinal or boxer and immediately found the answer. It is interesting to note how much Think Aloud data was generated by Fran even in these very simple searches. She was very talkative throughout the study and had more evaluating statements than any other participant.

Even though finding the answer to these two questions was easy, Bob, Paul and Chris still did some of planning and/or monitoring in each search. Bob spontaneously used language to solve the task and also to relate this search to his own background knowledge and experiences. Meichenbaum and Biemiller (1998) propose that students like Bob are in the *consultation* role and "they come to understand the task, and to be able to call upon the associated skills (in a literal, verbal sense) when new situations occur in which the skills are relevant" (p. 77).

Learners are unique and bring to a task their own skills, experience and vocabulary. The researcher has to keep this in mind when using concurrent verbal protocols as a way of gathering data. The work of Biemiller and Meichenbaum helps to explain why some searchers experienced difficulty generating complete Think Alouds. Those students who are not in the *consolidation* or *consultation* role in the given task may have difficulty in generating Think Alouds. To get the best and most complete data then, researchers must ensure that learners are given time to become familiar enough with the task so that they can speak about what they are doing. However, learners must not be so familiar with the task that it becomes automatic and they are unable to think out loud about the task.

It is a delicate balance that must be reached by the researcher and, obviously, one that is difficult to do with a group of junior high students. Biemiller and Meichenbaum (1992) suggest that sometimes "teachers and more advanced peers sometimes "think for" less self-directed children" (p. 77). It may be unreasonable to expect those students to generate complete Think Alouds. Some students have spent seven or more years in school becoming other-directed. These learners come to depend on others to act as their support systems. Others in the classroom end up doing the defining, planning and monitoring activities for the less self-directed learner. As a result, this becomes a "self-maintaining cycle" (p. 77).

One example of this other-direction can be seen in the following piece of transcript with Dave.

> J: Alrighty, so now who was the first man in space? So you've had some experience with this. What are you going to type in?
> *I am typing in the first man in space. There's no topics found.*
> J: Okay, so now what are you going to try?
> *Who was the first person in space?*
> J: What else do you know? What other topics might it be under? Try search by word rather than go. So no matches found. Okay. So close that with the x and find to search again. Try something else. Delete that and try something else.
> (types in who was the first man in space)
> J: Okay, what other words can you try? So, who was the first man in space isn't working. Where else might you try? Any ideas? What's going through your head? What other words are you thinking about? Or are you thinking about other words you can try? Do you know the names of any astronauts?
> *Neil Armstrong.*
> J: Why don't you give it a try? He may not be the first but he may be a place to start, eh?
> (types in Neal Armstrong)
> J: Just try Armstrong or maybe you spelled Neil wrong.

> *Neil A. Armstrong.*
> J: Try that. Okay, that's his picture. Go back and see if there's an article or you can see. What does this say? So who was he?
> *He was man on the moon.*

This learner was experiencing difficulty with the search. As a teacher, I began, unconsciously, to do the defining, planning and monitoring for the learner. Dave was a less self-directed learner and everything I knew about him told me this. Without knowing anything about the work of Biemiller and Meichenbaum, I began to act as a "mental crutch" for Dave as he searched.

Lynn's transcript reveals another pattern. This exchange was quite different from Dave's. Lynn was highly self-directed and quite familiar with the task.

> J: I want to know what the cardinal looks like, the bird looks like.
> *A cardinal?*
> J: Umm.
> *I don't know if this is going to work but I will try it again. (types in bird, cardinal)*
> *So just the appearance?*
> J: Um hum.
> *Okay.*
> J: Just the appearance.
> *Is this a picture?*
> J: I think so. Then you can click on cardinal, I think.
> *It gives the sound or something.*
> J: Yeah, I think it does.
> *Cool.*
> J: Um hm.
> *So is that all you need?*
> J: Yup.

Biemiller and Meichenbaum (1992) suggest that "teachers should strive to systematically monitor their students' social and self-discourse in order to infer the children's level of knowledge, strategies, and motivation" (p. 77). These are important clues to each student's level of competence and expertise. A researcher should do the same thing. In this case, I should have spent time observing and listening to the self-talk of each student as they searched so as to infer what role they were in. Those students who were in the *consolidation* or *consultation* role would then be ready to generate Think Alouds.

However, those students in the *acquisition* role should be allowed more time to become familiar with the task before being asked to do Think Alouds.

Biemiller and Meichenbaum suggested that "students who are more expert have the ability to nurture their own self-regulatory skills" (p. 77). Because teachers often provide planning and monitoring information, they may not "provide the less competent child with the same opportunities or tasks to practice to develop his or her self-regulatory competence" (p. 77). As a teacher and a researcher, it is disheartening to hear my own talk during the search sessions. At the time, I was just trying to help but now realize that I was influencing the kind of Think Alouds that some of the students generated. The work of Biemiller and Meichenbaum will be very important to me when designing future research.

There is no way to know whether the ability to generate Think Alouds in this research study can be attributed only to the role the learner was in, that is, *acquisition*, *consolidation*, or *consultation*. As Stratman and Hamp-Lyons suggest there are several other factors that may have influenced the Think Alouds. There could have been confusion as to what the researcher wanted when asking for the participant to Think Aloud. There was a cultural difference between the researcher and some of the participants that may have influenced the Think Alouds. The work of Scollon and Scollon (1981) demonstrated that their interethnic communication between me and some of the participants might have caused confusion. There may have been gender issues or learning style issues that influenced the Think Alouds. Any or all of these may have contributed to incomplete Think Alouds.

However, Biemiller and Meichenbaum presented a very interesting theory that appears to hold true in this situation. Their suggestions for helping all learners become more self-directed are good ones. Students "vary in the areas in which they have expertise" (Biemiller & Meichenbaum, 1992, p. 77). Teachers, teacher-librarians, and researchers need to be aware that differences exist and help learners move from the *acquisition* role through the *consolidation* role to the *consultation* role. Not only will this be of benefit to the learner; it may also help to generate the best Think Alouds possible.

6.8 Children and Adolescents as Information Seekers

Research on the information-seeking behaviour of children and adolescents is becoming more common but is still limited. According to Chelton and Thomas,

> While information systems often seem to assume a generic user in a decontextualized context, those who work with young people know that such a creature simply does not exist. Indeed, the developmental and maturational differences that will inevitably be observed in any group of adolescents preclude the imposition of such general assumptions. By the same token, assumptions related to the expertise of the user are likewise problematic. (p. 8)

Research using adolescent participants informs not only those who work in school libraries and young adult departments of public libraries but also those who serve adults. This study contributes to an understanding of the information-seeking processes of junior high students when accessing information using CD-ROM encyclopedias, in particular, and to information seeking, in general.

6.9 Chapter Summary

Chapter 6 has explored the connections between the findings from this study and the work of other researchers. The findings from this study indicate that some junior high students do not have the inherent skills to access information efficiently and effectively. This is problematic for teachers and teacher-librarians as they try to develop information literate students. The findings support the work of Bates who presented a berrypicking model of information seeking. Participants in this study used a variety of techniques to find the answers. They browsed, used the key features of the search by word and search by topic, used the electronic world atlas feature, tried related articles, asked questions of the researcher, looked at animations and pictures, scrolled through photographs of dogs, etc.

The Think Alouds and Think Afters provide support for the findings of Kuhlthau and her Information Search Process model. Across all searches, and within individual searches, participants followed the affective stages of the model. These feelings included uncertainty, confusion, frustration and doubt, clarity, sense of relief, and satisfaction. Support for the Tenopir et al. basic cycle of search behaviour was found in the observation, videotaping, and the Think Aloud data from this study. Participants followed the basic cycle and comments from the Think Alouds provided support for the steps which included: seeking assistance, rehearsing instructions, executing instructions, interpreting consequences, emoting to result, and, setting a subgoal. Some of the more complex searches demonstrated each of the steps several times. In the simple searches, only a few of the steps were apparent in the Think Alouds. Findings from this study also supported the work of Tenopir et al. and Bilal when they noted that participants tended to use the same strategies during searching and that those participants who tended to use simple search terms continued to do so throughout the searches.

This study found [illegible] participants tended to assign considerable intelligence to the system and use natural language queries. This supported the work of Marchionini (1989a). In keeping with the work of Large and his colleagues, this study found that more than half of the participants were able to find the answers to the questions within four minutes. Participants had more difficulty and needed more time to find the answers in complex searches than in simple searches. Participants did not have difficulty negotiating the interfaces of the two CD-ROM encyclopedias. The study found that participants sought assistance from others which supported the work of Solomon, Hirsch, and Gross.

The findings of this study also supported the work of Oliver and Oliver who noted that participants tended to prefer one strategy over others and that those with more computer experience used more options. Most of the participants did not make use of advanced search features which was in keeping with Hirsch's work. Participants in this study had trouble finding answers when they had to search through a lot of text just like in the work of Bilal and Gross. Hirsch and Fidel et al. found that participants were frustrated when results were not as expected, and this study confirmed that finding. Participants tended to look for the lines in articles that would answer the question and to move quickly between the article, article outline, and search box. This finding was also reported by Fidel et al.

In this study, several participants experienced difficulty searching the CD-ROM encyclopedias and generating Think Aloud data at the same time. The findings support the work Marchionini and Liebscher who were interested in the relationship between information seeking, cognitive load and mental models when using a new information system. The participants located the answers to almost all of the questions, yet several of them appeared to have an incomplete mental model of CD-ROM encyclopedias.

The findings from this study reported non-fiction hypertext reading patterns that were the same as those described by Anderson-Inman et al. Skimming, scanning/checking, reading, responding, studying and reviewing were demonstrated by the participants in this study. Two hypertext reading types from the work of Slatin were also seen in this study. Participants appeared to be either users or browsers.

Participants were asked to generate verbal data using Think Alouds and Think Afters for the study of their information-seeking processes. While some participants were able to do this, other participants experienced difficulty. One way to explain some of these difficulties came from the work of Biemiller and Meichenbaum. Children and adolescents are interesting as participants and information seekers and can contribute to a general understanding of information-seeking behaviour.

CHAPTER 7

IMPLICATIONS AND CONCLUSIONS

7.1 Introduction

This chapter explores the implications of this study for researchers and practitioners, that is, teachers and teacher-librarians. The implications are divided into sections that correspond with those in Chapter Six, that is, Information Literacy, Information Seeking Theory, Information Seeking in Electronic Environments, Schema and Mental Models in Electronic Environments, Reading in Electronic Environments, Think Alouds and Think Afters, and, Children and Adolescents and Information Seekers. Each section details suggestions for practitioners and researchers.

7.2 Information Literacy

7.2.1 Implications for Practitioners

This study explored the information-seeking processes of junior high students as they searched for information using CD-ROM encyclopedias. Of the nine information literacy standards of AASL and AECT (1998), standards 1 and 4 are most relevant to the findings of this study. They are:

> Standard 1*:* The student who is information literate accesses information efficiently and effectively.
> Standard 4*:* The student who is an independent learner is information literate and pursues information related to personal interests. (p. 8)

CD-ROM encyclopedias are just one small piece of the information technology that students are expected to use efficiently and effectively in classrooms and in school libraries. This study indicated that there are vast differences between participants in the time they take to find the answers to the same questions. Participants displayed different emotions during the search and they asked questions of the researcher. Teachers and teacher-librarians need be prepared to deal with the need of searchers to ask questions and to address the affective behaviours that may occur during searching.

This involves supporting small group and whole group discussions about search terms and search strategies. Gross' "shared information seeking" (p. 520) is a good way to think about this. Teachers and teacher-librarians need to provide opportunities for students to develop skills that will help them with the three main steps in searching, that is, generating search terms, selecting topics/articles from a retrieved list, and reading/skimming/scanning to locate the answer. Practitioners also need to acknowledge with their students that searching for information can be frustrating, confusing, upsetting, exciting, and challenging. Akin (1998) found that students feel confused, frustrated, mad, angry or even furious when they encounter too much information. Students need to know that these feelings are a normal part of the information-seeking process.

Teachers and teacher-librarians also need to give students the opportunity to search for information of a personal nature. Gross found that as students get older, into junior high and high school, less of their circulation transactions in libraries are related to personal interests. In this study, the participants enjoyed searching for their own self-generated questions. It was very interesting for me, as the researcher, to learn about their interests. Allowing students some choice in assignments, projects and reports, can support Standard 4. It can also be meaningful for students who sometimes find school remote from their interests.

7.2.2 Implications for Researchers

This research study focused on junior high students as they accessed information from CD-ROM encyclopedias. Much work still needs to be done in the area of information literacy research in schools and school libraries. It would be useful to compare and contrast the information-seeking processes of junior high students as they access information from other reference tools, both print and electronic. This should involve real assignments, project and reports as selected by the teacher, teacher-librarian or the student. Research should move to a more natural group setting in the library or a classroom and away from the laboratory setting. In this setting, participants should be observed as they interact with others, as they would normally do. Research should take into account this shared information seeking as suggested by Gross.

This does not diminish, however, the need for research about individuals as they search for information. Although in schools and school libraries it may be common for students to work together, there are still times when a student searches alone. This may be even more true as students use the Internet and other information technologies at home. Researching the information-seeking processes of junior high students must take into account their searching, both individually and in groups. In fact, researching information-seeking processes of students working in groups may disguise some of the specific information-seeking processes of individuals.

7.3 Information-seeking Theory

7.3.1 Implications for Practitioners

The work of Bates, Kuhlthau, and Tenopir et al. was very important to an understanding of this research study. Bates' berrypicking model suggests that users employed a wide variety of approaches and techniques when accessing information. Practitioners need to familiarize students with these techniques and provide opportunities for practice. Allowing for small group and large group discussions about searching will help to support Bates' ideas. It may also provide new techniques and ideas that are unique to one searcher but may be useful for all.

Kuhlthau's work on the information search process held true in this research study. The affective behaviours that are a part of the process of doing a research paper were also demonstrated in this study. Teachers and teacher-librarians need to support students when they feel overwhelmed, confused, frustrated and full of doubt. This study found that confidence improves over time. Teachers and teacher-librarians must support student use of the information technologies so that their confidence can improve. Practitioners must also help students to develop strategies and skills to deal with the affective stages of the ISP, that is, uncertainty, optimism, confusion, frustration and doubt, clarity, sense of direction, confidence, and, relief/satisfaction or disappointment. Explaining that feelings are normal when involved in research should be an important part of the work of teachers and teacher-librarians.

Using the model developed by Tenopir et al., practitioners can focus on the three domains of human behaviour. The first is the affective domain that controls goal selection. The second is the cognitive domain that determines the strategies necessary to reach goals. The third is the sensorimotor domain that implements the physical actions necessary to reach goals. Practitioners can also focus on the twelve steps:

1. Setting Goal (Affective)
2. Seeking Assistance (Affective)
3. Obeying Instructions (Affective)
4. Representing Instructions to Self (Cognitive)
5. Memorizing Instructions (Cognitive)
6. Rehearsing Instructions (Cognitive)
7. Executing Instructions (Sensorimotor)

8. Observing Consequences (Sensorimotor)
9. Interpreting Consequences (Cognitive)
10. Reacting to Change in Relation to Goal (Affective)
11. Emoting to Result (Affective)
12. Setting New Subgoal (Affective). (p. 253)

Teachers and teacher-librarians can provide the opportunity for students to learn skills and strategies that they can apply at each step in the Tenopir et al. cycle.

7.3.2 Implications for Researchers

Researchers need to continue to test these models and theories in real-life settings with junior high students with a variety of backgrounds, experiences, and abilities. Bates' berrypicking theory should be tested with junior high students as they work on school assignments, projects and reports. Kuhlthau's Information Search Process model has been tested with a range of students. It would be interesting to document the affective behaviours of students involved in shared information seeking. Does working together change the affective behaviours?

Tenopir's et al.'s model fits with the findings of this study. It needs to be tested in real-life settings with a variety of reference tools, both print and electronic. I am especially interested in whether the model works with Internet searching by junior high students.

7.4 Information-seeking in Electronic Environments

7.4.1 Implications for Participants

There are many implications for teachers and teacher-librarians as a result of this research study. Participants need instruction and practice to develop new skills and strategies when searching. These skills and strategies should focus on the three main search tasks, that is, generating search terms, selecting topics from a retrieved list, and, skimming and scanning through text to find the answer. The participants tended to use search terms from the questions or the whole question, rather than using synonyms. Some of the participants had difficulty selecting topics and articles from the retrieved list. Long articles were not read as carefully as short articles. Participants need skimming and scanning techniques to move through the long articles. They also needed skills to move back and forth between the article and the article outline.

The amount of time needed by participants to find the answers to the questions varied. Participants had different frustration levels. Some were very easily frustrated and needed skills to help with search strategies. Others were easily distracted and needed skills to stay on track with their search. Teachers and teacher-librarians need to encourage students to ask questions during the search. This can be self-talk, talk with peers, or talk with teachers and teacher-librarians. This can help support the social nature of junior high students and of searching.

Teachers and teacher-librarians also need to teach students the basics and variations of full-text searching. In Microsoft Encarta Encyclopedia Deluxe 2000, the words first, woman, and space needed to appear in an article for the article to be retrieved. In 1999 World Book (Deluxe), on the other hand, first, woman, and space, needed to appear in a sentence for the article to be retrieved. Differences in default free-text searching caused problems for junior high students in this study. It also added to the frustration level of some of the participants.

The factors identified by the researcher, the key informants, and the participants indicated as influenced the information-seeking processes of junior high students should also be used to inform practitioners. One factor identified was finding the right keyword and knowing when to use a more general or specific term. Practitioners need to teach skills and strategies to students to help them generate search terms in a variety of different situations and with a variety of different information sources. Students with these skills may experience less frustration.

Key informants also indicated that students with more computer experience had more success using technology. Providing many opportunities for students to use the technology is important. It is especially important for those who do not have access to computers at home. Another factor that influences search success is asking questions of others when in doubt. Teachers and teacher-librarians need to support students in asking, sharing, and helping others while searching. They also need to explain to students that asking questions is an important part of searching and something to be expected.

Reading ability is another factor that may influence the information-seeking processes of junior high students. Teacher and teacher-librarians can help those students who have difficulty with reading by teaching them skimming and scanning skills. Participants with low literacy levels should be encouraged to ask others for help when they encounter new vocabulary. Teacher-librarians need to provide CD-ROM encyclopedias with a variety of reading levels so that all students can successfully locate information. Students with low literacy levels may require extra time to locate information. Teachers and teacher-librarians can introduce the topic and new vocabulary to students to ensure adequate prior knowledge.

Teachers and teacher-librarians need to spend some time explaining the differences between databases, indexing and abstracting services, CD-ROM encyclopedias, and the Internet. For some of these participants, finding information on the computer was the same no matter what the information source. These participants did not differentiate between CD-ROM encyclopedias and the Internet and they expressed that they would use the same strategies to search a CD-ROM encyclopedia as they would to search the Internet. Sometimes these strategies were successful but sometimes they were not. The strategies may not have been at all successful on the Internet, for example Alaska, space, and Egypt.

7.4.2 Implications for Researchers

This research study has generated many questions and ideas for further research in the area of information seeking in electronic environments. I am very interested in looking at the information-seeking processes of junior high students as they use a variety of information technologies to locate information, for example, other CD-ROMs and CD-ROM encyclopedias, databases, electronic journals, and the Internet. New research must focus on real-life tasks in schools and school libraries. Participants must not be separated from their peers but, rather, the data collection should include the shared information seeking that happens in junior high classrooms and school libraries. I am also interested in looking at these shared information-seeking processes over a longer period of time with a group of students.

7.5 Schema and Mental Models in Electronic Environments

7.5.1 Implications for Practitioners

Resources once available only in print are now available in electronic formats on-line and on CD-ROM. Some students may have had very little experience with the print versions, and instead have only a mental model of an electronic encyclopedia. Others will have a well-defined mental model of the print resource and an incomplete mental model of an electronic encyclopedia. As more and more resources become available in electronic formats, teachers and teacher-librarians will have to help students develop and refine their mental models of these resources. One important place to start is the encyclopedia. This study found that some students experienced difficulties understanding the contents and organization of a CD-ROM encyclopedia. Whether this was because of an incomplete mental model is unknown but helping students understand the similarities and differences between print and electronic encyclopedias can only help them develop strategies to use when accessing information from each.

7.5.2 Implications for Researchers

Marchionini and Liebscher suggest that cognitive load may be needed to develop and refine mental models of electronic resources previously available in print. I am interested in those students who have no mental model of print encyclopedias because they have only used CD-ROM encyclopedias for their searching. How does this CD-ROM encyclopedia mental model differ from a print encyclopedia mental model? What about people who have an incomplete mental models of both print and CD-ROM encyclopedias? How do these differences influence the information-seeking processes of people using CD-ROM encyclopedias? How does an Internet mental model influence the information-seeking processes of people using CD-ROM encyclopedias? Are there students who search exclusively using computers and is there such thing as an electronic information seeking mental model?

7.6 Reading in Electronic Environments

7.6.1 Implications for Practitioners

Encyclopedias on CD-ROM may contain the same textual information as their print counterparts but there are different reading skills involved in moving through the text. Teachers and teacher-librarians need to provide opportunities for students to develop skills in electronic literacy. This study determined that certain reading skills may be useful for students using CD-ROM encyclopedias. Longer articles in the CD-ROM encyclopedias had article outlines that the participants could use to move through the text. Students need to have an understanding of what an article outline is and what information is contained in the headings and subheadings. Some participants in this study had difficulty moving between the article outline and the article itself. Those participants who were most successful at finding answers skimmed through the article outline looking for clues or answers, rather than skimming through the whole article. Since participants tended not to skim through a long article, an understanding of the usefulness of the article outline is important.

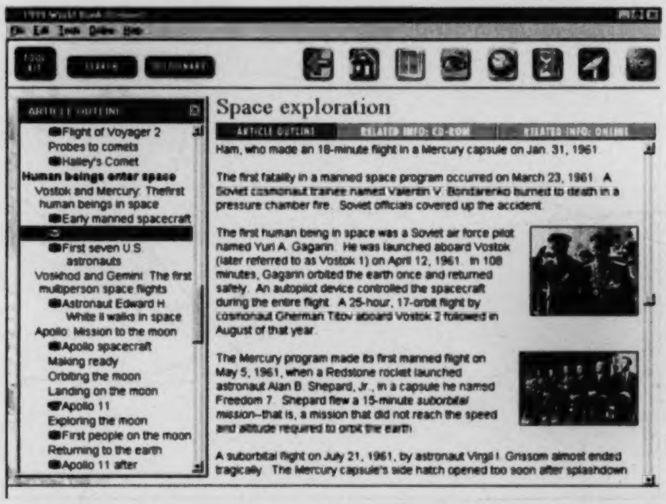
Anderson-Inman et al. described six hypertext-reading patterns that they noticed when observing middle school students reading a hypertext short story. They were:

- Skimming: Moving through the text at a pace too fast for reading or studying.
- Checking: Moving through the text and/or resources systematically, apparently checking things out, but not reading or responding.

- Reading: Visiting text pages for periods long enough to read the material but with little or no use of the resources.
- Responding: Accessing resources, but not in a way that appears related to reading the text.
- Studying: Moving through the text pages systematically, visiting pages long enough to read them, and using resources in an integrated manner.
- Reviewing: Rereading the text and/or accessing the available resources a second time. (p. 283)

The basic skills of skimming and checking, what I call scanning in this dissertation, are very important in the longer articles. In the Think Alouds, several participants talked about looking for a number or the word first or a man's name, for example, scanning. These techniques were very useful, yet some students may not know how or when to do this. In both Microsoft Encarta Encyclopedia Deluxe 2000 and 1999 World Book (Deluxe), search terms are highlighted in the text of the article. Some of the participants used the highlighted search terms as a guide for their scanning/checking. Those who did so found the answers much more quickly. This is a technique that all searchers should use.

Figure 83: Space Exploration Article in 1999 World Book (Deluxe)


ARTICLE OUTLINE
Flight of Voyager 2
Probes to comets
Halley's Comet
Human beings enter space
Vostok and Mercury: Thefirst human beings in space
Early manned spacecraft
First seven U.S. astronauts
Voskhod and Gemini: The first multiperson space flights
Astronaut Edward H. White II walks in space
Apollo: Mission to the moon
Apollo spacecraft
Making ready
Orbiting the moon
Landing on the moon
Apollo 11
Exploring the moon
First people on the moon
Returning to the earth
Apollo 11 after
ARTICLE OUTLINE
RELATED INFO: CD-ROM
RELATED INFO: ONLINE

Space exploration

Ham, who made an 18-minute flight in a Mercury capsule on Jan. 31, 1961.

The first fatality in a manned space program occurred on March 23, 1961. A Soviet cosmonaut trainee named Valentin V. Bondarenko burned to death in a pressure chamber fire. Soviet officials covered up the accident.

The first human being in space was a Soviet air force pilot named Yuri A. Gagarin. He was launched aboard Vostok (later referred to as Vostok 1) on April 12, 1961. In 108 minutes, Gagarin orbited the earth once and returned safely. An autopilot device controlled the spacecraft during the entire flight. A 25-hour, 17-orbit flight by cosmonaut Gherman Titov aboard Vostok 2 followed in August of that year.

The Mercury program made its first manned flight on May 5, 1961, when a Redstone rocket launched astronaut Alan B. Shepard, Jr., in a capsule he named Freedom 7. Shepard flew a 15-minute *suborbital mission*–that is, a mission that did not reach the speed and altitude required to orbit the earth.

A suborbital flight on July 21, 1961, by astronaut Virgil I. Grissom almost ended tragically. The Mercury capsule's side hatch opened too soon after splashdown

Some of the participants had difficulties moving between article outline and article and knowing where to start reading (see Figure 83). Several times participants started reading at the top of the screen, for example, "Ham, who made an 18-minute flight in a Mercury capsule on Jan 31, 1961." This was very interesting to me. These participants assumed that when they clicked on the topic on the article outline that the section of the article would appear at the top of the screen. When this did not happen, they missed the information available on the screen. Several times participants did not see the second paragraph that started "The first human being in space…" and had to rethink their search strategies.

Rabinowitz (1987), in Before Reading: Narrative conventions and the politics of interpretation, suggests that there are four conventions that inform our reading in complex ways. The first of these is called the rules of notice. These rules are tacit and shared by readers and writers alike. One rule is that titles are privileged. Another is that first and last sentences are privileged. These rules appear to cause problems when reading electronic text, like the example above. Following the rules of notice, the participants read the first sentence, the one beginning "Ham…" This does not seem to be relevant to the question, "Who was the first man in space?" The participant then must rethink the search. If Rabinowitz's rules of notice are tacit and understood from our knowledge of print texts and if these rules do not apply in electronic text, then teachers and teacher-librarians must help students develop new skills.

Slatin presented three types of hypertext fiction readers who he called browsers, users, and co-authors. In this study, I found that browsers and users exist in non-fiction reading in hypertext as well. Browsers are readers who wander "aimlessly (but not carelessly) through an area, picking things up and putting them down as curiosity or momentary interest dictates" (p. 875). Users, on the other hand, enter "the hyperdocument in search, usually, of specific information and leave it again after locating that information" (p. 875). Teachers and teacher-librarians need to acknowledge the similarities and differences between these types of readers. They also need to support those students who tend to be browsers to help them move through the material to find answers. However, browsers and users need to be given the opportunity to read for pleasure as well.

It will be important for teachers and teacher-librarians to look to their students to see the many different and unique ways that they use and interact with information technologies. Encouraging students to share useful tips and hints with others in the class can help everyone become better searchers.

7.6.2 Implications for Researchers

This research study generated many questions about reading in electronic environments, generally, and in CD-ROM encyclopedias, specifically. I am very interested in the work of Peter Rabinowitz and his rules of reading. Are these rules going to change, or do they need to change in electronic environments? How do these tacit rules influence electronic reading? What about reading on the Internet? How similar and different is it to reading on a CD-ROM encyclopedia? Do students need new skills and strategies to read electronically? How can we prepare students for lifelong electronic reading? These are important questions to begin to think about.

7.7 Think Alouds and Think Afters

7.7.1 Implications for Practitioners

There is much for teachers and teacher-librarians to learn by listening to participants who generate Think Alouds and Think Afters for a search task. Students doing Think Alouds and Think Afters also can learn much about their own thought processes. In several cases, participants in this study used their own Think Alouds and Think Afters to change or monitor their later searches. I also think there is much to learn from having whole group and small group Think Alouds while searching. I believe that hearing how other people define, plan, monitor, and evaluate while searching may be useful to other searchers. This may especially be true for those students who have low-self regulatory behaviour.

7.7.2 Implications for Researchers

Think Alouds and Think Afters generated rich data to help describe the information-seeking processes of junior high students as they accessed information using CD-ROM encyclopedias. Although some of the participants had difficulties generating complete protocols, there was still a vast amount of data gathered. Researchers wanting to describe a complex phenomenon would do well to look to this method.

It is important now that researchers who use concurrent or retrospective protocols as data begin to move away from the positivistic paradigm and set the qualitative data firmly within the naturalistic paradigm. Terms such as subjects, reliability, validity, and generalizability should not be used when speaking about Think Alouds and Think Afters in naturalistic inquiry. The data gathered from Think Alouds and Think Afters is inherently qualitative. It represents the unique perspective of each individual participant. Think Alouds and Think Afters cannot be generalizable to another group of participants. What qualitative researchers are looking for, instead, are themes, patterns, explanations and regularities. The goal of the qualitative researcher is to establish trustworthiness. This involves prolonged engagement with the participants, learning the culture of the research setting and community, persistent observation, triangulation, peer debriefing, and member checks, among other things.

Research using small group Think Alouds and Think Afters also interests this researcher. The methods should also be applied to other information sources, both print and non-print, to gain a rich description of the information-seeking processes of a variety of participants. It is also important to think about ways to make sure the methods are culturally relevant. This could involve having one participant learn how to search using CD-ROM encyclopedias and then having that participant teach another, perhaps younger participant, about searching. This follows the tradition of the Native elders teaching children about a task. It is important to remember the work of Scollon and Scollon (1981) and their work on interethnic communication. Their work presented other factors that may have influenced the generation of Think Aloud data. Researchers should continue to use the method in culturally diverse communities to evaluate the strengths and weaknesses for collecting data.

It is also interesting to continue to look at the work of Biemiller and Meichenbaum in relation to Think Alouds and information-seeking processes. Their model, called the Three Dimensions of Mastery, deserves more study. Are there similarities between highly self-regulated students and successful information seekers? If so, what are they and how can we teach the skills to others?

7.8 Children and Adolescents as Information Seekers

7.8.1 Implications for Practitioners

Children and adolescents look to their teachers and teacher-librarians to help them become effective and efficient information seekers. For that reason, practitioners need to continually use research to inform their practice. They also need to support research projects in their school districts, schools and school libraries. Much of the research about information seeking uses participants at the university level. Studies of importance to teachers and teacher-librarians can be carried out by making elementary, middle, junior and senior high school settings available to researchers.

Teachers and teacher-librarians should also be encouraged to write and report about the interesting observations, strategies, and ideas that are happening in their schools and school libraries. We can all work together to develop a rich account of the information-seeking processes of the students in our schools.

7.8.2 Implications for Researchers

Children and adolescents provide an interesting population for the study of information-seeking processes. Working with younger participants can be a particularly rewarding experience. Having children and adolescents as participants also allows for a wide variety of abilities and experiences. University students, while interesting and available to most university researchers, may not have the range of abilities seen in an elementary or junior high classroom. It is this range of abilities that can be most interesting in a study of information seeking.

7.9 Conclusion

This project began as a result of a long-time interest in junior high and high school students' use of CD-ROM encyclopedias. It was determined that, although work had been done to examine how a variety of students used CD-ROM encyclopedias, no one had asked these specific questions within the context of an Arctic town. The context in which the research appears, therefore, is original. Also original is the use of the combination of methods including interviews with participants and key informants, observation, Think Alouds and Think Afters, and videotaping of the search screen.

This research examined the information-seeking processes which junior high students at Samuel Hearne Secondary School in Inuvik, Northwest Territories employ when using CD-ROM encyclopedias. Relevant literature from LIS, education, and psychology was reviewed to assess learning theories, models and research that could be applied to this specific, real-life situation. The research questions were:

- What information-seeking processes do junior high students use when accessing CD-ROM encyclopedias?
- How similar and different are these information-seeking processes when junior high students search for information on self-generated, teacher-generated and researcher-generated topics?
- What factors do participants, key informants and the researcher see as important to an understanding of the information-seeking processes of junior high students?

This case study was limited to twelve junior high students in one school. The three core classroom teachers selected junior high students from a variety of backgrounds. These participants had different reading abilities, language and travel experiences, and cultural backgrounds. Key informants also contributed to an understanding of the information-seeking processes of junior high students in Inuvik, Northwest Territories. One teacher was selected from each grade level, that is, seven, eight, and nine. The other key informant had multiple roles in the school including Library Assistant and Special Needs Assistant.

Samuel Hearne Secondary School was selected as the case because of its very interesting cultural mix and because of its emphasis on information technology over the past eight years. Chapter 4 explored the context of the research. I worked at SHSS for six years as a teacher and teacher-librarian. In carrying out the research, I believe most participants saw me as a teacher rather than a researcher. It was very important to me that the participants felt that they were cared for and respected. To ensure this, informed consent was gained from participants and their parents, teachers, administration and interested community groups through the NWT Research License process. This also involved having participants read the profiles found in Chapter 4 and making corrections. It was also important that member checks were carried out throughout the data analysis.

This study provides an understanding of how a small group of junior high students in Inuvik, Northwest Territories search for information on CD-ROM encyclopedias. The findings of this research provide significant information for teachers and teacher-librarians who are interested in information-seeking processes in electronic environments. An in-depth understanding can inform teachers and teacher-librarians about the needs of students to be successful in electronic environments. This study provides an understanding of the search strategies and search terms these students employed in a variety of information problems. Teachers and teacher-librarians will be able to use the research as a basis to begin their own observations of the information seeking of students in their schools. The use of the Think Aloud method and Think After method is also significant as it moves away from the positivistic paradigm and places the method firmly in the naturalistic paradigm.

Chapter 5 presented an in-depth discussion of the information-seeking processes of the participants as they searched for answers to researcher-generated, teacher-generated and self-generated questions. The same four questions were answered by all of the participants in Search Session 1. In Search Session 2, participants answered questions based on their Social Studies curriculum. In Search Session 3, participants asked their own questions of the CD-ROM encyclopedias.

Each of the twelve participants was asked the same four fact-based questions in the first search session. All twelve participants were able to locate the answers to the four questions in Search Session 1 although the amount of time needed to find the answer varied from participant to participant and from question to question. Several of the participants became frustrated, yet the amount of time before they became frustrated varied. One participant did not reach a level of frustration, even after more than twenty minutes, because he was interested in the other information he found.

The participants had an overall average time of just over 5 ½ minutes to answer each question in Search Session 1. The participants used a variety of search terms and some spent a long time just staring at the screen. Navigation within the CD-ROM encyclopedias was a frustrating problem during the first searches. The participants struggled with article outlines and list of topics. They had trouble navigating and several times became lost or ended up back at the initial search page. Some of the participants used the whole question as an initial search term to try to locate the answer. This worked better in Microsoft Encarta Encyclopedia Deluxe 2000 because it searches for the terms by article while 1999 World Book (Deluxe) searches by sentence in the default mode.

Each of the grade seven participants answered the same four questions during Search Session 2. The questions were developed in consultation with the teacher from the Social Studies curriculum. The grade-seven participants had an overall average time of just over four minutes to answer each question. They used a variety of initial search terms and spent quite a long time typing in those terms. This was especially a problem in Microsoft Encarta Encyclopedia Deluxe 2000 and created some frustration for participants. The 1999 World Book (Deluxe) provides a spell check feature that is helpful. The CD-ROM encyclopedia also does not begin to search until the user clicks *go* or *search by word*. This is a very good feature for novice users as it allowed them to choose the term they wished to use and to get the spelling as accurate as possible before they search. 1999 World Book (Deluxe) then presents alternate spellings for the student to select. Microsoft Encarta Encyclopedia Deluxe 2000 does provide this feature after the student stops typing and the search by the CD-ROM encyclopedia is complete.

Each of the grade eight participants was asked the same four questions during Search Session 2. The questions were developed in consultation with the grade-eight teacher from the Social Studies curriculum. The grade seven students were working on an Egypt unit at the time of the data collection. Dave and Abby seemed to have the most difficulty with the searches. They took longer on most searches that Lynn and Ken and were unable to find the answer to the first question on the official language of Egypt. Both were inexperienced searchers and poor readers so skimming, scanning and reading seemed to take longer for them.

Each of the grade nine participants answered the same four questions during Search Session 2. The questions were developed in consultation with the grade-nine teacher from the Social Studies curriculum. The grade nine students were working on Canadian geography, specifically inland waterways, at the time of the data collection. The grade nine participants used one, two or three words from the question for the initial search term. It also became apparent that background knowledge can help when searching for questions about countries, rivers and geography. The participants moved through the encyclopedias purposefully and spent very little time sitting and thinking about search terms. For the most part, they just jumped right in and were willing to make adjustments to search terms as needed. They spent an average of just over four minutes for all the questions in Search Session 2.

Search Session 3 required participants to bring four of their own questions to the next meeting. These questions could be about any topic in which the participant was interested. Search Session 3 provided some very interesting approaches to information seeking on CD-ROM encyclopedias. All of the participants generated questions that were important to their personal lives and interests. Most of the questions were ones that could be found in an encyclopedia. Abby spent the most amount of time finding the answers to her questions while Eric and Lynn spent the least amount of time. The mean amount of time needed to answer their self-generated questions was just over six minutes.

Eric used natural language sentences when searching for most of his answers. This was a departure from the way he had previously searched. Paul continued to search in the same way during his final search session. He was interested in information in general and was not looking for a specific answer. Paul felt free to explore the information and enjoyed exploring his topics of interest. Fran continued to be easily frustrated when the answer was not found immediately after typing in an initial search term. Carol still typed in general search terms to find answers to her questions. This made it difficult for her to make her way through the large number of retrieved topics. Dave used general topics for search terms as well. This worked well for him compared to his earlier searching when he was typing in the whole question. Ken used the whole question as an initial search for each of his final questions. He did not do this during the first two search sessions. Lynn continued to be a very effective searcher. She was confident and found all but one of the answers easily. Lynn also enjoyed exploring some of the features of the encyclopedia. Abby chose questions that were very difficult to find in an encyclopedia. She did not really have a sense of what kind of information might be in an encyclopedia.

Chris continued to use simple search terms to locate information. Two of his questions were difficult to answer using an encyclopedia. Bob had difficulty with one question. But found answers to the rest of the questions easily. He continued to use general search terms to find the answers. Mary found the answers to her first three questions easily. The fourth question was not specific and, therefore, it was difficult for her to find an answer. Instead she just spent time reading about a lot of race car drivers rather than finding one famous race car driver. Sue's questions were based on her interest in science. She found the answer to her first question quickly but the second two took much longer. She was very interested in the topic and spent a lot of time reading about the disintegration of starts and exobiology.

Information-seeking processes are the processes that include selecting a search term, reading, selecting, viewing, determining relevance of topics and articles, and locating the answer. They also include skills, strategies, and metacognitive processes. The junior high students in this study used a variety of information-seeking processes while searching for information on CD-ROM encyclopedias. The participants in this study all began their search by typing something into the search box. Participants tended to use terms from the question as a starting point. Rarely did participants generate totally new search terms. When typing in search terms, almost all participants rehearsed or repeated what they were typing as they typed it.

The search term entered either retrieved a list of topics or gave the message "no topics found". At that point, participants had to determine what to do next. When faced with "no topics found", the usual approach was to try another search term. Some of the participants asked for help at this point, some of them sat quietly and thought about another search term, some were frustrated, some were confused, and some immediately tried a different term. Others needed a little nudging to get them started again. When an initial search term retrieved a list of topics, the participants were then faced with selecting one to view. Often this was difficult, as the list of topics could be very long. Participants with any background knowledge tended to use it when faced with the list of retrieved topics. Most of the participants skimmed through the list looking for a topic that seemed relevant. If they found a topic that they felt was relevant they would click on it to take them to the article. When faced with a list of unfamiliar topics, working from top to bottom was one strategy used by several of the participants.

Several of the participants had difficulty determining relevant articles from the list. This may have been due to several factors, for example, reading ability, background knowledge, and, understanding of the question. Those participants who were identified by their teachers as weak students had the most difficulties determining relevance. As a result their searches took longer and they tended to be the ones who were unable to find an answer.

When in an article, participants skimmed, scanned or read the article depending on its length. If the search terms were highlighted, several of the participants would scan the article looking for those terms. With long articles, I encouraged participants to look at the article outline. Some of them skimmed the list of sections within the article outline before going directly to the article. Others moved back and forth between the article outline and the article itself. Shorter articles, on the whole, were read more carefully than longer articles. Most of the participants knew that the size of the bar on the vertical scroll determined the length of the article. They would use that to determine whether to read or to skim the article.

Once the participants were in the appropriate article, they were usually able to locate the answer quickly. Even those students who were poor readers managed to locate the answer in the text, even if it took a little bit longer. A couple of times participants missed the answer while skimming through the article and started reading again. In almost every case, they saw the answer the second time through the article. A couple of times, participants tried another search term and ended up in the same article and then located the answer. Participants tended to read the answer out loud to me when they located it. Usually a sense of relief or accomplishment was apparent at this stage in the search.

The participants tended to perform three main processes. They entered search terms, skimmed through the list of retrieved topics to find a relevant article, and, read, skimmed or scanned through article outlines and articles to find the answer. Sometimes the participant had to return to the list of retrieved topics many times after being unable to locate the relevant article that contained the answer. Sometimes the participant had to type in several search terms and sometimes the participant had to look through many articles and article outlines to find the answer. These three processes seem to be the most important to the search. Skills can be taught to help students be more successful at each step.

Most participants were able to find the answers to the questions in Search Sessions 1, 2 and 3. Their information-seeking processes were the same over the three search sessions. They continued to type in a search term, select relevant topics from the retrieved list and skim, scan and read the article outlines and articles. The only changes that were noticed were the selection of search terms and the confidence with navigation. All of the participants seemed more confident using the CD-ROM encyclopedias over time. By

Search Session 2, participants were moving confidently through the CD-ROM encyclopedias and remembered differences between each one. During Search Session 2 and Search Session 3, some participants began to explore other features, search by word in 1999 World Book (Deluxe), and move back and forth from article outlines, articles, search box and retrieved lists with ease. In spite of the rich variety of experiences brought to the study by the participants, there were no differences found in the information-seeking processes.

At the end of the research study in Inuvik, I had a sense of some of the factors that influenced the information-seeking processes of the junior high participants. Some of the ideas came from the participants themselves and others came from the interviews with the key informants. Others came from my observations of and discussions with the participants as they searched. Participants needed to be able to type in a search term that would give them a list of topics. Sometimes one word was a good choice, for example, *cardinal*, other times it was not, for example, *Alaska* or *space*. They also needed to be able to generate other search terms if the first one was unsuccessful. Students need skills to move from the general to the specific and back again when searching.

Time was also a factor that appeared to influence the participants. Some participants had a sense of how much time it should take to find the answer. If the answer was not found within that amount of time, then they became frustrated. The amount of time varied by participant with some becoming frustrated if the initial search term did not locate the answer, while other students were much more patient. Patience and perseverance were used by all of the key informants when talking about factors affecting search success. The amount of time and patience with searching appeared to be a very individual thing.

Previous computer experience was appeared to be a factor affecting information-seeking processes. I noticed that those students who had Internet access at home were more comfortable navigating in the CD-ROM encyclopedias. Eric and Lynn were the most comfortable with the mouse, the keyboard and the navigation tools. Key informants commented that those students who ask questions are better searchers. Several of the participants who asked questions while searching used that new information in the later searches.

Reading ability was another important factor mentioned by all key informants. Those participants with low literacy levels and a small vocabulary had trouble with their searches. They often went to irrelevant articles because they could not read or comprehend the topic. They also seemed to read more of each article, perhaps because they were unable to skim and scan. Participants who used skimming and scanning skills to help them with their search were more successful. Several participants made comments in the Think Alouds that demonstrated these skills. They scanned the text following the highlighted words. They used the article outline more effectively than those participants who had low literacy skills did.

Sometimes these participants were unable to understand what they were reading. These participants were more patient than many of the other participants when trying to find information. It suggested to me that they may be used to needing more time to find the answer. The notion of instant gratification may be foreign to them because finding answers and reading is always difficult. Dave and Abby did become frustrated eventually, after about ten minutes of searching.

Those participants who understood the differences between an encyclopedia and the Internet were able to generate better initial search terms. Some of the participants expected the encyclopedia to be able to interpret whatever they entered as an initial search term. Very few of the participants understood what full-text searching means. A few came to understand what kind of search terms worked best in each of the encyclopedias as the search sessions progressed. For others, they never really seemed to understand why one encyclopedia worked differently from the other.

Becoming information literate depends on an understanding of the information-seeking processes of individuals using all kinds of information sources. An understanding of CD-ROM encyclopedia searching by junior high students contributes to this understanding. Looking to information-seeking theory, this study compared and contrasted the work of Bates, Kuhlthau, and Tenopir et al. Bates's berrypicking model suggests that information seekers use a variety of techniques to find information from both print and electronic sources. In this study, the students browsed, used the key features of search by word and search by topic, used the electronic world atlas feature, tried related articles, asked questions of the researcher, looked at animations and pcitures, scrolled through photographs, etc. The options were limited compared to searching in a library but the participants did indeed use a variety of different techniques.

The affective part of Kuhlthau's Information Search Process model was found to hold true in this study. Participants moved through the stages of the model as they progressed through more difficult searches. Think Alouds of all participants provided examples of the feelings at different stages in the model. Searching for information on CD-ROM encyclopedias brought out many feelings in the participants. It is important to recognize that the feelings of participants played an important part in their information-seeking processes

Tenopir et al.'s model of the basic cycle of search behaviour also fit with these research findings. They identified three domains of human behaviour: the affective, the cognitive, and the sensorimotor. The basic cycle of search behaviour consists of twelve steps. The first three steps are affective and involve setting the goal for the search, seeking assistance, and obeying instructions. The next three steps are cognitive and involve representing instructions to self, memorizing the instructions, and rehearsing the instructions. Two sensorimotor steps, executing instructions and observing consequences, follow. A cognitive step, interpreting the consequences, precedes the final three affective steps which are, reacting to change in relation to goal, emoting to result, and setting a new subgoal. Each step in the model was located many times in the Think Alouds, Think Afters and on the videotapes. Some of the more difficult searches and those participants who generated a lot of verbal data in their Think Alouds showed many or all of the steps. Other searches only revealed one or two of the steps. Overall, the data revealed that participants were going through the Tenopir et al. cycle as they searched for information using CD-ROM encyclopedias.

This research study provided support for many of the previous findings of researchers working in the area of information seeking in electronic environments. Participants were eager to be involved in the research and often approached me to ask when the next session would be. Many other students were also keen to participate because the research involved using computers. Participants tended to use the same strategies over the three search sessions. These participants, who were novice users, had a variety of needs including support in the areas of the affective, cognitive and sensorimotor domains. The participants assumed that the CD-ROM encyclopedias had considerable intelligence and used natural language terms or the whole question as initial search terms.

Participants in this study needed a wide range of times to find the answers to the researcher- and teacher-generated questions. Only 60% of the participants were able to find the answers to the questions within four minutes. Participants found some searches to be more difficult than others. For these more difficult questions, the time needed to find the answer was five times more than the easier questions. Participants asked for assistance from the researcher throughout their searches. There was no difference by grade between the number of questions asked of the researcher.

Participants in this study did not often become disoriented within the CD-ROM encyclopedia. Scrolling, use of the back button, and navigating the links were three important physical behaviours that all students used when searching. The most novice computer users tended to move between the search box, the article outlines and the articles. Those participants with more computer experience used the back button more and explored more of the features. Eight of the participants had computers at home and only three had Internet access.

Participants became frustrated when the displayed results did not match their expectations. This occurred when participants retrieved no topics, too many topics, or when topics appeared to be irrelevant. Many of the participants in this study wanted and needed support during the searches. This involved help with search terms, navigation, search strategies, and spelling. Once participants had located a relevant article, most tended to scan it to find the exact word, phrase or line that would answer the question. Participants were more likely to scroll through short articles than long ones. Participants did not appear to have difficulty ignoring some of the multimedia features of the CD-ROM encyclopedias.

Some of the participants did not appear to have a complete mental model of either a print encyclopedia or a CD-ROM encyclopedia. Over the three search sessions, some of the participants began to develop or redefine their mental models. However, some participants had difficulty transferring their knowledge of print encyclopedias to CD-ROM encyclopedias.

Participants used a variety of reading patterns while accessing information from CD-ROM encyclopedias. This included skimming, scanning/checking, reading, responding, studying, and reviewing. The most successful searchers used a combination of these reading patterns to locate information. All students need to be given the opportunity to practice these reading patterns in hypertext. There seemed to be two kinds of hypertext readers in this research. A small number of participants appeared to be browsers, and wandered through the text for pleasure. The majority of the participants were users, they had a clear sense of purpose for reading in the CD-ROM encyclopedias. Continued observation of elementary and junior high students can help inform teachers and teacher-librarians of the reading patterns and skills needed when reading in electronic environments. Teachers and teacher-librarians can also help students realize they have a choice of reading patterns.

For novice searchers, the process of searching for information while generating Think Alouds proved to be difficult. Participants who are in the acquisition role, that is, those who are just learning a task, may have difficulty doing a task and talking about it to others. Therefore, participants in this role may be unable to generate detailed verbal protocols about their information-seeking processes. It is important for researchers and practitioners to pay attention to student's social and self-discourse to infer their role in a particular task. Instead of giving students more opportunity to practice Think Alouds, students may need more time to practice the task before generating Think Aloud data.

The information-seeking processes of children and adolescents should be interesting to all those who work in classrooms and school libraries. In recent years, more research in the area of information seeking has been carried out with younger participants. As a researcher interested in children and adolescents as information seekers, I hope to see this trend continue.

The role of this research has been to explore the information-seeking processes of junior high students as the access information using CD-ROM encyclopedias. It has contributed to a greater understanding of these information-seeking processes in the specific context and it does provide an illumination of the general problem, for example, information seeking in electronic environments. Researchers are encouraged to extend the study by using similar methods in different contexts, with different information sources, and with small and large groups of participants over an extended period of time. It is hoped that this case study suggests to the readers general and specific ideas for use in similar situations. It attempts to provide a starting point for the development of information literacy programs that deal specifically with CD-ROM encyclopedia searching, and with information seeking in electronic environments in general.

REFERENCES

Adler, P. A., & Adler, P. (1998). Observational techniques. In N. K. Denzin & Y. S. Lincoln (Eds.), Collecting and Interpreting Qualitative Materials (pp. 79-109). Thousand Oaks, CA: Sage.

Akin, L. (1998). Information overload and children: A survey of Texas elementary school students. School Library Media Quarterly Online, 1. Retrieved June 2, 2000 from the World Wide Web: http://www.ala.org/aasl/slmq/overload.html.

Ambron, S., & Hooper, K. (1988). Interactive multimedia: Visions of multimedia for developers, educators & information providers. Redmond, WA: Microsoft.

American Association of School Librarians and Association for Educational Communications and Technology (1988). Information power: Guidelines for school library media programs. Chicago: American Library Association; Washington: Association for Educational Communications and Technology.

Anderson-Inman, L., Horney, M. A., Chen, D.-T., & Lewin, L. (1994). Hypertext literacy: Observations from the ElectroText Project. Language Arts, 71, 279-287.

Ayersman, D. J., & Reed, W. M. (1998). Relationships among hypermedia-based mental models and hypermedia knowledge. Journal of Research on Computing in Education, 30(3), 222-238.

Bankhead, B. (1991). Through the technology maze: Putting CD-ROM to work. School Library Journal, 37(10), 44-49.

Barker, J., & Tucker , R. N.(1990). The interactive learning revolution: Multimedia in education and training. London, UK: Kogan Page.

Bates, M. J. (1989). The design of browsing and berrypicking techniques for the on-line search interface. On-line Review, 13(5), 407-424.
(2), 143-172.

Baumbach, D. J. (1990). CD-ROM: Information at your fingertips! School Library Media Quarterly, 18(3), 142-149.

Biemillier, A., & Meichenbaum, D. (1992) The nature and nurture of the self-directed learner. Educational Leadership, 50(2), 75-80.

Biemiller, A., Shany, M., Inglis, A., & Meichenbaum, D. (1998). Factors influencing children's acquisition and demonstration of self-regulation on academic tasks.

In D. H. Schunk & B. J. Zimmerman (Eds.), Self-regulated learning: From teaching to self-reflective practice (pp. 203-224). New York, NY: the Guilford Press.

Bilal, D. (1999). Web search engines for children: A comparative study and performance evaluation of Yahooligans, Ask Jeeves for Kids, and Super Snooper^{TM}. In L. Woods (Ed.), ASIS '99: Proceedings of the 62nd ASIS annual meeting (Vol. 36, pp. 70-83). Medford, NJ: Information Today.

Bilal, D. (2000). Children's use of the Yahooligans! web search engine: I. Cognitive, physical, and affective behaviours on fact-based search tasks. Journal of the American Society for Information Science, 51(7), 646-665.

Bilal, D., & Watson, J. S. (1998). Children's paperless projects: Inspiring research via the web. In 64th IFLA General Conference. Amsterdam: International Federation of Library Associations.

Bloom, B. S. (1956). Taxonomy of educational objectives: The classification of educational goals. London, UK: Longmans.

Borgman, C. L. (1982). Mental models: Ways of looking at a system. ASIS Bulletin, December, 38-39.

Borgman, C. L. (1989a). All users of information retrieval systems are not created equal: An exploration into individual differences. Information Processing and Management, 25(3), 237-251.

Borgman, C. L. (1986b). The user's mental model of an information retrieval system: an experiment on a prototype on-line catalog. International Journal of Man-Machine Studies, 24, 47-64.

Borgman, C. L, Hirsh, S. G., Walter, V. A., & Gallagher, A. L. (1995). Children's searching behaviour on browsing and keyword on-line catalogs: The science library catalog project. Journal of the American Society for Information Science, 46(9), 663-684.

Branch, J. L. (1999). Jennifer Branch, teacher-Librarian, Inuvik, Canada: A day in my life. Retrieved on December 14, 1999 from the World Wide Web: http://www.hi.is/~anne/day_branch.html.

Branch, J. L. (2000). The trouble with Think Alouds: Generating data using concurrent verbal protocols. In A. Kublik (Ed.), Dimensions of a global information science. Proceedings of the 28th Annual Conference of the Canadian Association for Information Science. Edmonton, Alberta: Canadian Association for Information Science. Retrieved May 23, 2000 from the World Wide Web: http://www.slis.ualberta.ca/cais2000/.

Branch, J. L. (in press). Investigating the information-seeking processes of adolescents: The value of using Think Alouds and Think Afters. Library and Information Science Research.

Brown, M. E. (1991). A general model of information-seeking behaviour. In ASIS '91: Proceedings of the 54th American Society for Information Science annual meeting (pp. 9-14). Medford, NJ: Learned Information.

Burbules, N. C. (1998). Rhetorics of the web: Hyperreading and critical literacy. In I. Snyder (Ed.), Page to Screen (pp. 102-122). London, UK: Routledge.

Butterworth, M. (1992). Online searching and CD-ROM in British schools. Education for Information, 10(1), 35-48.

Cacioppo, J. T., von Hippel, W., & Ernst, J. M. (1997). Mapping cognitive structures and processes through verbal content: The thought-listing technique. Journal of Consulting and Clinical Psychology, 65(6), 928-940.

Chelton, M. K., & Thomas, N. P. (1999). Introduction: Why a special topic issue on youth issues? Journal of the American Society for Information Science, 50(1), 7-9.

Chen, C. (1990). The challenge to library and information profession in the visual information age. Microcomputers for Information Management, 7(4), 255-272.

Chen, L. C. (1990-1991). Interactive video technology in education: Past, present and future. Educational Technology Systems, 19(1), 5-19.

Cohen, L., & Manion, L. (1994). Research methods in education. London: Routledge.

Creswell, J. W. (1994). Research design: Qualitative and quantitative approaches. Thousand Oaks, CA: Sage.

Cross, D. R., & Paris, S. G. (1988). Developmental and instructional analyses of children's metacognition and reading comprehension. Journal of Educational Psychology, 80(2), 131-142.

Davey, B. (1983). Think aloud – Modeling the cognitive processes of reading comprehension. Journal of Reading, October, 44-47.

Davidson-Shivers, G. V., Shorter, L., & Jordan, K. (1997). Children's learning strategies, encoding processes, and navigational decisions in a hypermedia concept lesson. In Proceedings of Selected Research and Development Presentations at the 1997 National convention of the Association for Educational Technology (pp. 21-29).

De Corte, E. (1990). Learning with new information technologies in schools: Perspectives from the psychology of learning and instruction. Journal of Computer Assisted Learning, 6, 69-87.

Denzin, N. K., & Lincoln, Y. S. (1998). Collecting and interpreting qualitative materials. Thousand Oaks, CA: Sage.

Eisenberg, M. B., & Berkowitz, R. E. (1988). Curriculum Initiative: An Agenda for Library Media Programs. Norwood, NJ: Ablex.

Eisenberg, M. B., & Berkowitz, R. E. (1990). Information Problem-Solving: The Big Six Skills Approach to Library and Information Skills Instruction. Norwood, NJ: Ablex.

Eisenberg, M. B., & Brown, M. K. (1990). Current themes regarding library and information skills instruction. In Woolls, B. (Ed.), The Research of School Library Media Centers (pp. 99-110). Castle Rock, Co: Hi Willow Research and Publishing.

Eisenberg, M. B., & Spitzer, K. L. (1991). Information technology and services in schools. In M. E. Williams (Ed.), Annual Review of Information Science and Technology (Vol. 26, pp. 243-285). Medford, NJ: Learned Information.

Ericsson, K. A., & Simon, H. A. (1984). Verbal reports as data. Cambridge, MA: MIT Press.

Ericsson, K. A., & Simon, H. A. (1993). Verbal reports as data (2nd ed.). Cambridge, MA: MIT Press.

Fawcett, G. (1993). Using students as think aloud models. Reading Research and Instruction, 33(2), 95-104.

Fidel, R. (1984). On-line searching styles: A case-study-based model of searching behaviour. Journal of the American Society for Information Science, 35(4), 211-221.

Fidel, R. (1991a). Searchers' selection of search keys: I. The selection routine. Journal of the American Society for Information Science, 42(7), 490-500.

Fidel, R. (1991b). Searchers' selection of search keys: II. Controlled vocabulary of free-text searching. Journal of the American Society for Information Science, 42(7), 501-514.

Fidel, R. (1991c). Searchers' selection of search keys: III. Searching styles. Journal of the American Society for Information Science, 42(7), 515-527.

Fidel, R., Davies, R. K., Douglass, M. H., Holder, J. K., Hopkins, C. J., Kushner, E. J., Miyagishima, B. K., & Toney, C. D. (1999). A visit to the information mall: Web searching behavior of high school students. Journal of the American Society for Information Science, 50(1), 24-37.

Fidel, R., & Soergel, D. (1983). Factors affecting on-line bibliographic retrieval: A conceptual framework for research. Journal of the American Society for Information Science, 34(3), 163-180.

Garner, R. (1982). Verbal-report data on reading strategies. Journal of Reading Behavior, 14(2), 159-167.

Glesne, C., & Peshkin, A. (1992). Becoming qualitative researchers: An introduction. White Plains, NY: Longmans.

Gross, M. (1999). Imposed queries in the school library media center: A descriptive study. Library and Information Science Research, 21(4), 501-521.

Hammond, M. (1994). Measuring the impact of IT on learning. Journal of Computer Assisted Learning, 10(4), 251-260.

Hayes, J. R., & Flower, L. S. (1983). Uncovering cognitive processes in writing: An introduction to protocol analysis. In P. Mosenthal, L. Tamor & S. A. Walmsley (Eds.), Research on writing: Principles and methods (pp. 207-220). New York, NY: Longman.

Herring, J. E. (1992). Information technology in schools: The role of the school librarian and the teacher. London, UK: Library Association.

Hirsh, S. (1999). Children's relevance criteria and information seeking on electronic resources. Journal of the American Society for Information Science, 50(14), 1265-1283.

Hooten, P. (1989). Online catalogs: Will they improve children's access? Journal of Youth Services in Libraries, 2, pp. 267-272.

Huberman, A. M., & Miles, M. B. (1998). Data management and analysis methods. In N. K. Denzin & Y. S. Lincoln (Eds.). Collecting and interpreting qualitative materials (pp. 179-245). Thousand Oaks, CA: Sage.

Hughes, J. E., Packard, B. W., & Pearson, P. D. (1998) Reading classroom explorer: Navigating and conceptualizing a hypermedia environment. Retrieved May 2, 1999 from the World Wide Web: http://readingonline.org/research/explorer/.

Irving A. (1985). Study and information skills across the curriculum. London, UK: Heinemann Educational Books.

Irving, A. (1982). Information retrieval in education - A worthy tradition? Computer Education, June, 15-16.

Kavale, K. & Schreiner, R. (1979). The reading processes of above average and average readers: A comparison of the use of reasoning strategies in responding to standardized comprehension measures. Reading Research Quarterly, 15(1), 102-128.

Kuhlthau, C. C. (1983) The research process: Case studies and interventions with high school seniors in advanced placement English classes using Kelly's theory of constructs. Ed.D. Dissertation. New Brunswick, NJ: Rutgers University.

Kuhlthau, C. C. (1988a). Developing a model of the library search process: Cognitive and affective aspects. Reference Quarterly, 27, Winter, 232-242.

Kuhlthau, C. C. (1988b). Meeting the information needs of children and young adults: Basing library media programs on developmental states. Journal of Youth Services in Libraries, 1, 51-57.

Kuhlthau, C. C. (1988c). Longitudinal case studies of the information search process of users in libraries. Library and Information Science Research, 10, 257-304.

Kuhlthau, C. C. (1988d). Perceptions of the information search process in libraries: A study of changes from high school through college. Information Processing and Management, 24(4), 419-427.

Kuhlthau, C. C. (1991). Inside the search process: Information-seeking from the user's perspective. Journal of the American Society for Information Science, 42(5), 361-371.

Kuhlthau, C. C. (1993). Seeking meaning: A process approach to library and information services. Norwood, NJ: Ablex.

Kuhlthau, C. C. (1995). The process of learning from information. School Libraries Worldwide, 1(1), 1-12.

Kuhlthau, C. C. (1996). The concept of a zone of intervention for identifying the role of intermediaries in the information search process. Retrieved April 4, 1999 from the World Wide Web: http://www.asis.org/annual-96/ElectronicProceedings/kuhlthau.html.

Kuhlthau, C. C., Turock, B. J., George, M. W., & Belvin, R. J. (1990). Validating a model of the search process: A comparison of academic, public and school library users. Library and Information Science Research, 12, 5-31.

Kumbruck, C. (1998). Hypertext reading: Novice vs. expert reading. Journal of Research in Reading, 21(2), 160-172.

Large, A. & Beheshti, A. (2000). Primary school students' reaction to the web as a classroom resource. In A. Kublik (Ed.), Dimensions of a global information science. Proceedings of the 28th Annual Conference of the Canadian Association for Information Science Edmonton, Alberta: Canadian Association for Information Science. Retrieved from the World Wide Web: http://www.slis.ualberta.ca/cais2000/.

Large, A., Behesti, J., & Breleux, A. (1998). Interface navigation by grade-six students: A case study of three multimedia CD-ROM products. In E. G. Toms, D. G. Campbell & J. Dunn (Eds.). Information science at the dawn of the next millenium: Proceedings of the 26th annual conference of the Canadian Association for Information Science (pp. 289-302). Toronto, ON: CAIS.

Large, A., Beheshti, J., Breuleux, A., & Renaud, A. (1994a). A comparison of information retrieval from print and CD-ROM versions of an encyclopedia by elementary school students. Information Processing and Management, 3(4), 499-513.

Large, A., Beheshti, J., Breuleux, A., & Renaud, A. (1994b). Multimedia and comprehension: A cognitive study. Journal of the American Society for Information Science, 45(7), 515-528.

Large, A., Beheshti, J., Breuleux, A., & Renaud, A. (1995). Multimedia in primary education: How effective is it? School Library Media Quarterly, 23(1), 19-25.

Large, A., Beheshti, J., Breuleux, A., & Renaud, A. (1996). Effect of animation in enhancing descriptive and procedural texts in a multimedia learning environment. Journal of the American Society for Information Science, 47(6), 437-448.

Large, A., Beheshti, J., & Moukdad, H. (1999). Information seeking on the web: Navigational skills of grade-six primary school students. In L. Woods (Ed.), ASIS '99: Proceedings of the 62nd ASIS annual meeting (Vol. 36, pp. 84-97). Medford, NJ: Information Today.

Laurillard, D. (1995). Multimedia and the changing experience of the learner. British Journal of Educational Technology, 26(3), 179-189.

Liebscher, P., & Marchionini, G. (1988). Browse and analytical search strategies in a full-text CD-ROM encyclopedia. School Library Media Quarterly, 16(4), 223-233.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic Inquiry. Thousand Oaks,CA: Sage.

Loerke, K. (1994). Teaching the library research process in junior high. School Libraries in Canada, 14, 23-6.

MacKnight, C. B., & Baroni, J. (1993). A comparison of the retrieval effectiveness of electronic and paper implementations. In Proceedings of the Conference of the Society for Applied Technologies (pp. 8-13).

Marchionini, G. (1989a). Information-seeking strategies of novices using a full-text electronic encyclopaedia. Journal of the American Society for Information Science, 40(1), 54-66.

Marchionini, G. (1989b). Making the transition from print to electronic encyclopedias: Adaptation of mental models. International Journal of Man-Machine Studies, 30, 591-618.

Marchionini, G. (1991). Technological trends and implication: Toward the new millennium. School Library Media Annual, 9, 182-187.

Marchionini, G. (1992). Interfaces for end-user information seeking. Journal of the American Society for Information Science, 43(2), 156-163.

Marchionini, G., & Liebscher, P. (1991). Performance in electronic encyclopaedias: Implications for adaptive systems. In ASIS '91: Proceedings of the 54th American Society for Information Science Annual Meeting (pp. 39-48). Medford, NJ: Learned Information.

Marchionini, G., & Shneiderman, B. (1991). Finding facts vs. browsing knowledge in hypertext systems. In O. Boyd-Barrett & E. Scanlon (Eds.), Computers and learning (pp. 250-262). Wokingham, UK: Addison-Wesley.

Marshall, S. (1995). Schemas in problem solving. Cambridge, UK: Cambridge University Press.

Matthews, S. (1990). CD-ROMs in school libraries (British Library Research and Development Report 6001). London: British Library.

McCarthy, R. (1993). CD-ROM spins into schools. Electronic Learning, October, 10-17.

McGrath, D. (1992). Hypertext, CAI, paper, or program control: Do learners benefit from choices? Journal of Research on Computing in Education, 24(4), 513-532.

McGregor, J. H. (1993). Cognitive processes and the use of information: A qualitative study of higher-order thinking skills used in the research process by students in a gifted program. PhD Dissertation. Florida State University.

McGregor, J. H. (1994a). Information seeking and use: Students' thinking. Journal of Youth Services in Libraries, 8(1), 69-76.

McGregor, J. H. (1994b). An analysis of thinking in the research process. School Libraries in Canada, 14(2), 4-7.

Meichenbaum, D., & Biemiller, A. (1992). In search of student expertise in the classroom: A metacognitive analysis. In M. Pressley, K. R. Harris, & J. T. Guthrie (Eds.), Promoting academic competence and literacy in school (pp. 3-56). San Diego, CA: Academic Press.

Meichenbaum, D., & Biemiller, A. (1998). Nurturing independent learners: Helping students take charge of their learning. Cambridge, MA: Brookline Books.

Mendrinos, R. B. (1989). CD-ROM: Research strategies for life. In A. Lathrop(Comp.) Online and CD-ROM databases in school libraries: Readings (pp. 91-93). Englewood, CO: Libraries Unlimited.

Mendrinos, R. B. (1992). CD-ROM and at-risk students: A path to excellence. School Library Journal, 38(10), 29-31.

Mendrinos, R. (1994). Building information literacy using high technology. Englewood, CO: Libraries Unlimited.

Merriam, S. B. (1988). Case study research in education: A qualitative approach. San Francisco, CA: Jossey-Bass.

Microsoft Corporation. (1999). Microsoft Encarta Encyclopedia Deluxe 2000. Redmond, WA: Microsoft.

Miles, M. B., & Huberman, A. M. (1994). Qualitative data analysis: An expanded sourcebook (2nd ed.). Newbury Park, CA: Sage Publications.

Miller, L., & Olson, J. (1994). Putting the computer in its place: a study of teaching with technology. Journal of Curriculum Studies, 26(2), 121-141.

Mitchell, G., & Dewdney, P. (1998). Mental models theory: Applications for library and information science. Journal of Education for Library and Information Science, 39(4), 275-281.

Murtaugh, M. (1984). A model of grocery shopping decision process based on verbal protocol data. Human Organization, 43(3), 243-251.

Nahl, D. & C. Tenopir (1996). Affective and cognitive searching behaviour of novice end-users of a full-text database. Journal of the American Society for Information Science, 47(4), 276-286.

Nash, C., & Steadman, S. (1994). Evaluation and development: CD-ROMs in schools scheme. Coventry, UK: National Council for Educational Technology.

National Council for Educational Technology (1989). Information skills and the national curriculum: A summary sheet. Coventry, UK: NCET.

Newell, A., & Simon, H. A. (1972). Human problem solving. Englewood Cliffs, CA: Prentice-Hall.

Oliver, R., & Oliver, H. (1996). Information access and retrieval with hypermedia information systems. British Journal of Educational Technology, 27(1), 33-44.

Pain-Lewins, H., & Watson, L. (1990a). Microcomputers and school libraries in the United Kingdom: Part 1. Computers in Libraries, 10(1), 22-24.

Pain-Lewins, H., & Watson, L. (1990b). Microcomputers and school libraries in the United Kingdom: Part 2. Computers in Libraries, 10(2), 48-50.

Pappas, M. L. (1993). Information skills for electronic resources. Ohio Media Spectrum, 45(1), 11-12.

Pappas, M., & Geitgey, G. (1994). Observing student searches in an electronic encyclopedia. The Book Report, 12(5), 13-14.

Patton, M. Q. (1990). Qualitative evaluation and research methods. Newbury Park, CA: Sage Publications.

Perzylo, L. (1993). The application of multimedia CD-ROMs in schools. British Journal of Educational Technology, 24(3), 191-197.

Perzylo, L., & Oliver, R. (1992). An investigation of children's use of a multimedia CD-ROM product for information retrieval. Microcomputers for Information Management, 9(4), 225-239.

Pitts, J. M. (1994). Personal understandings and mental models of information: A qualitative study of factors associated with adolescents' information seeking and use. School Library Media Annual, 12, 200-202.

Pitts, J. M. (1995). Mental models of information: The 1993-1994 AASL/Highsmith Research Award study. School Library Media Quarterly, Spring, 177-184.

Pressley, M., & Afflerbach, P. (1995). Verbal protocols of reading: The nature of constructively responsive reading. Hillsdale, NJ: Lawrence Erlbaum.

Rabinowitz, P. J. (1987). Before reading: Narrative conventions and the politics of interpretation. Ithaca, NY: Cornell University Press.

Ransdell, S. (1995). Generating thinking-aloud protocols: Impact on the narrative writing of college students. American Journal of Psychology, 108(1), 89-98.

Reinking, D. (1987). Reading and computers: Issues for theory and practice. New York: Teachers College Press.

Reinking, D. (1993). A new focus for the National Reading Research Center. The Computing Teacher, March, 29-31.

Reinking, D. (1994). Electronic literacy: Perspectives in reading research. Athens, GA: National Reading Research Center.

Reinking, D., & ChanLin, L.-J. (1994). Graphic aids in electronic texts. Research and Instruction, 33(3), 207-232.

Reinking, D., & Rickman, S. S. (1990). The effects of computer-mediated texts on the vocabulary learning and comprehension of intermediate-grade readers. Journal of Reading Behavior, 22(4), 395-409.

Riding, R., & Chambers, P. (1992). CD-ROM versus textbook: A comparison of the use of two learning media by higher education students. Educational and Training Technology International, 29(4), 342-349.

Roberts, L. W., Clifton, R. A., & Wiseman, J. (1989). Exploring the value orientations of Inuit and White students: An empirical inquiry. Canadian Journal of Native Education, 16(1), 12-23.

Rothenberg, D. (1994). Information technology in education. In M. E. Williams (Ed.), Annual review of information science and technology (Vol. 29, pp. 277-302). Medford, NJ: Learned Information.

Ruddell, R. B., & Speaker, B., Jr. (1985). The interactive reading process: A model. In H. Singer & R. B. Ruddell (Eds.), Theoretical models and processed of reading (pp. 751-793). Newark, DE: International Reading Association.

Rumelhart, D. E. (1977). Toward an interactive model of reading. In S. Dornic (Ed.), Attention and performance IV: Proceedings of the sixth international symposium on attention and performance (pp. 573-603). Hillsdale, NJ: Lawrence Erlbaum.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), Theoretical issues in reading comprehension (pp. 33-58). Hillsdale, NJ: Lawrence Erlbaum.

Rumelhart, D. E. (1981). Schemata: The building blocks of cognition. In Guthrie, J. T. (Ed.). Comprehension and teaching: Research reviews (pp. 3-26). Newark, DE: International Reading Association.

Rumelhart, D. E. (1985). Toward an interactive model of reading. In H. Singer & R. B. Ruddell (Eds.), Theoretical models and processes of reading (pp. 722-750). Newark, DE: International Reading Association.

Russo, J. E., Johnson, E. J. & Stephens, D. L. (1989). The validity of verbal protocols. Memory & Cognition, 17(6), 759-769.

Schacter, J., K.W.K. Chung & A. Dorr (1998). Children's internet searching on complex problems: Performance and process analyses. Journal for the American Society of Information Science, 49(9), 840-849.

Scollon, R., & Scollon, S. B. K. (1981). Narrative, literacy and face in interethnic communication. Norwood, NJ: Ablex.

Selfe, C. (1997). Redefining literacy: The multilayered grammars of computers. Retrieved April 3, 1999 from the World Wide Web: http://edie.cprost.sfu.ca/~coho/galan/hyper/intro.html.

Slatin, J. M. (1990). Reading hypertext: Order and coherence in a new medium. College English, 52(8), 870-83.

Small, R. V., & Ferreira, S. M. (1994a). Information location and use, motivation, and learning patterns when using print or multimedia information resources. Journal of Educational Multimedia and Hypermedia, 3(3-4), 251-273.

Small, R. V., & Ferreira, S. M. (1994b). Multimedia technology and the changing nature of research in the school library. The Reference Librarian, 44, 95-106.

Snyder, I. (1996). Hypertext: The electronic labyrinth. New York, NY: New York University Press.

Solomon, P. (1993). Children's information retrieval behaviour: A case analysis of an OPAC. Journal of the American Society for Information Science, 44(5), 245-264.

Soloway, E. (1991a). Quick, where do the computers go? Communications of the ACM, 34(2), 29-33.

Stake, R. E. (1995). The art of case study research. Thousand Oaks, CA: Sage.

Stake, R. E., & Mabry, L. (1995). Case study for a deep understanding of teaching. In A. C. Ornstein (Ed.), Teaching: Theory into practice (pp. 294-304). Boston, MS: Allyn and Bacon.

Steadman, S., Nash, C. & Eraut, M. (1992). CD-ROM in schools scheme. Coventry: National Council for Educational Technology.

Steinberg, E. R. (1986). Protocols, retrospective reports, and the stream of consciousness. College English, 48(7), 697-712.

Stratman, J. F., & Hamp-Lyons, L. (1994). Reactivity in concurrent think-aloud protocols: Issues for research. In P. Smagorinsky (Ed.), Speaking about writing: Reflections on research methodology (Vol. 8, pp. 89-111). Thousand Oaks, CA: Sage.

Sullivan, P., & Seiden, P. (1995). Educating online catalog users: The protocol assessment of needs. Library Hi Tech, 3(2), 11-19.

Tallman, J. I., & Henderson, L. (1999). Constructing mental model paradigms for teaching electronic resources. School Library Media Research. Retrieved on February 16, 1999 from the World Wide Web: http://www.ala.org/aasl/SLMR/mental.htm.

Taylor, R. S. (1968). Question-negotiation and information seeking in libraries. College and Research Libraries, May, 178-194.

Tenopir, C., Nahl-Jakobovits, D., & Howard, D. L. (1991). Strategies and assessments online: Novices' experience. Library and Information Science Research, 13, 237-266.

Trivison, D., Chamis, A. Y., Saracevic, T., & Kantor, P. (1986). Effectiveness and efficiency of searchers in on-line searching: Preliminary results from a study of information seeking and retrieving. In ASIS '86: Proceedings of the 49th American Society for Information Science annual meeting (pp. 341-349). Medford, NJ: Learned Information.

Trotter, A. (1993b). Planning for multimedia. The Executive Educator, 15(6), 18-21.

Truett, C. (1994). New technologies in reference services for school libraries: How their use has changes the teaching of library and research skills in North Carolina. The Reference Librarian, 44, 123-144.

Trumball, D., Gay, G., & Mazur, J. (1992). Students actual and perceived use of navigational and guidance tools in a hypermedia program. Journal of Research on Computing in Education, 24(3), 315-328.

van Someren, M. W., Barnard, Y. F., & Sandberg, J. A. C. (1994). The think aloud method: A practical guide to modelling cognitive processes. London, UK: Academic Press.

Whitney, P., & Budd, D. (1996). Think-aloud protocols and the study of comprehension. Discourse Processes, 21(3), 341-351.

Wilson, T. D. (1994). The proper protocol: Validity and completeness of verbal reports. Psychological Science, 5(5), 249-251.

World Book, Inc. (1999). 1999 World Book (Deluxe). Chicago, IL: 1999 World Book (Deluxe).

Xie, H., & Cool, C. (1998). The importance of teaching "interaction" in library and information science education. Journal of Education for Library and Information Science, 39(4), 323-331.

Yang, S. C. (1997). Information seeking as problem-solving using a qualitative approach to uncover the novice learners' information-seeking processed in a Perseus hypertext system. Library and Information Science Research, 19(1), 71-92.

Yildiz, R., & Atkins, M. (1993). Evaluating multimedia applications. Computers in Education, 21(1/2), 133-139.

Yin, R. K. (1994). Case study research: Design and methods (2nd ed.). Thousand Oaks, CA: Sage.

APPENDIX A

School of Library and Information Studies Ethics Review Guidelines

School of Library and Information Studies
Ethics Review Guidelines

Project Title: Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

Applicant: Jennifer L. Branch BA, BEd, MLIS

Date: Monday, May 17, 1999

1. Statement of Research Problems and Methods.

My proposed research will examine the information-seeking processes which junior high school students employ when using CD-ROM encyclopedias. This research focus has emerged from my observations of students as a teacher and teacher-librarian. In junior high, students' classroom work requires them to access much more information than any time previously in their school career.

A case study will be conducted at Samuel Hearne Secondary School in Inuvik, Northwest Territories. The study will include junior high students with a range of academic abilities and knowledge of computers and CD-ROM encyclopedias. The participants will be selected from Aboriginal and Non-Aboriginal students in Grades 7, 8 and 9. The context within which the participants search will be explored through observations in the school and through interviews with the key informants in the school and the community.

Participants at this age can begin to gain some independence when searching for information. To determine the information-seeking processes of no more than eighteen junior high students in my study, I propose to use two verbal protocol analysis methods, the Think Aloud method and the Think After method. Students are going to search for the answers to questions generated by the researcher, the curriculum and the participant. They will also answer interview questions to determine their level of computer use and comfort with CD-ROM encyclopedias and to discuss which experiences they feel are important to understanding their information-seeking processes. The talk of the students is going to be recorded using audiotapes and videotapes (Think Alouds and interviews). Then students are going to be shown the video of their searches and are going to be asked to elaborate on their information-seeking processes. A draft interview and observation guide is attached.

Findings from the case study will assist teachers and teacher-librarians in assisting junior high students to more effectively access information from electronic encyclopedias and other online research tools.

Who are the participants and how will they be involved in your research?
No more than 18 junior high students will be participating in study. They will be selected by their teachers from grades seven to nine. Other key informants from the school and the community will be interviewed to provide information to help understand the context of the study.

2. How will the nature and purpose of the research be explained to participants.
Students selected to participate in the study will be asked to meet with the researcher as a group. The study will be explained to the students and they will each be given a letter asking them to participate in the study. At this time, letters will also be sent home with the students to their parents. Before this meeting the researcher will telephone each parent/guardian to explain the meeting and to briefly explain the research. Arrangements will be made to meet with each parent/guardian after the letters have been sent home. Parents/guardians will be given the opportunity to ask any questions during this home visit. Letters of consent will be left with the parent/guardian that can be returned to the school. The researcher will make a follow-up phone call to each parent/guardian several days after the home visit. See attached letters and consent forms

3. How will informed consent of participants be obtained?
Informed consent will be obtained by having the participant and the parent/guardian sign consent forms after being introduced to the nature of the research.

4. Are children, captive or dependent populations used? If so, detail how consent will be obtained.
The nature and purpose of the research will be explained to parents and then consent forms will be made available for parents to sign.

5. How will provision be made for exercising the right to opt out at any time?
Letters and consent forms indicate that participants and/or their parents may opt out of the research at any time. The researcher will also inform the participants that they may refuse to answer any of the interview questions or refuse to complete any of the search activities.

6. How will confidentiality and anonymity be maintained?
Participants will be referred to by pseudonyms. Every effort will be made to include no other information that could link the participant with his/her true identity.

7. Is deception and/or risk involved in the project? If so, how will the interests of the subject be protected?
No deception and/or risk are involved in the project.

APPENDIX B

School of Library and Information Studies Ethics Approval

SCHOOL OF LIBRARY AND INFORMATION STUDIES
Ethics Approval

Monday, May 17, 1999

Requester:

Jennifer L. Branch BA, BEd, MLIS, PhD (Candidate)

Advisors Name:

Dr. Dianne Oberg
Dr. Ruth Hayden

Title of Project:

Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

FOR OFFICE USE ONLY

Review Panel

Names:

Toni Samek
Alvin Schrader
Dennis Ward
Julia Ellis

Signature of Panel Chairperson : Margaret Mackey

Date: August 1, 1999

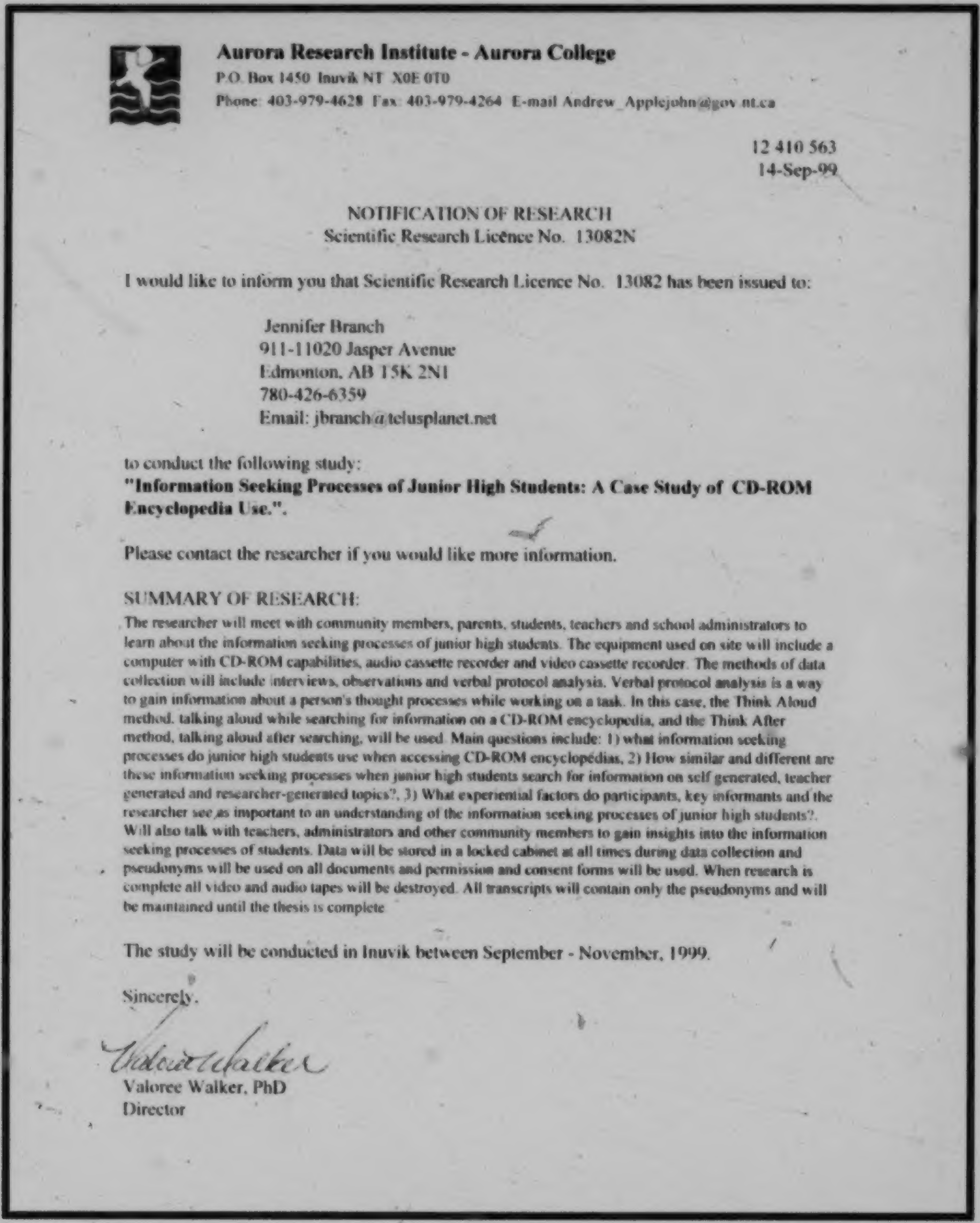
[✓ This application conforms with the provisions contained in the *University Policy Related to Ethics in Human Research* document.]

_ This application does not conform with the provisions contained in the *University Policy Related to Ethics in Human Research* document.

19/08/98

APPENDIX C

Notification to Community Organizations of Research License



Aurora Research Institute - Aurora College
P.O. Box 1450 Inuvik NT X0E 0T0
Phone: 403-979-4628 Fax: 403-979-4264 E-mail Andrew_Applejohn@gov.nt.ca

12 410 563
14-Sep-99

NOTIFICATION OF RESEARCH
Scientific Research Licence No. 13082N

I would like to inform you that Scientific Research Licence No. 13082 has been issued to:

Jennifer Branch
911-11020 Jasper Avenue
Edmonton, AB T5K 2N1
780-426-6359
Email: jbranch@telusplanet.net

to conduct the following study:
"Information Seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use.".

Please contact the researcher if you would like more information.

SUMMARY OF RESEARCH:
The researcher will meet with community members, parents, students, teachers and school administrators to learn about the information seeking processes of junior high students. The equipment used on site will include a computer with CD-ROM capabilities, audio cassette recorder and video cassette recorder. The methods of data collection will include interviews, observations and verbal protocol analysis. Verbal protocol analysis is a way to gain information about a person's thought processes while working on a task. In this case, the Think Aloud method, talking aloud while searching for information on a CD-ROM encyclopedia, and the Think After method, talking aloud after searching, will be used. Main questions include: 1) what information seeking processes do junior high students use when accessing CD-ROM encyclopedias, 2) How similar and different are these information seeking processes when junior high students search for information on self generated, teacher generated and researcher-generated topics?, 3) What experiential factors do participants, key informants and the researcher see as important to an understanding of the information seeking processes of junior high students?. Will also talk with teachers, administrators and other community members to gain insights into the information seeking processes of students. Data will be stored in a locked cabinet at all times during data collection and pseudonyms will be used on all documents and permission and consent forms will be used. When research is complete all video and audio tapes will be destroyed. All transcripts will contain only the pseudonyms and will be maintained until the thesis is complete

The study will be conducted in Inuvik between September - November, 1999.

Sincerely,

Valoree Walker

Valoree Walker, PhD
Director

Aurora Research Institute - Aurora College
P.O. Box 1450 Inuvik NT X0E 0T0
Phone: 403-979-4628 Fax: 403-979-4264 E-mail Andrew_Applejohn@gov.nt.ca

12 410 563
14 Sep 99

Page 2

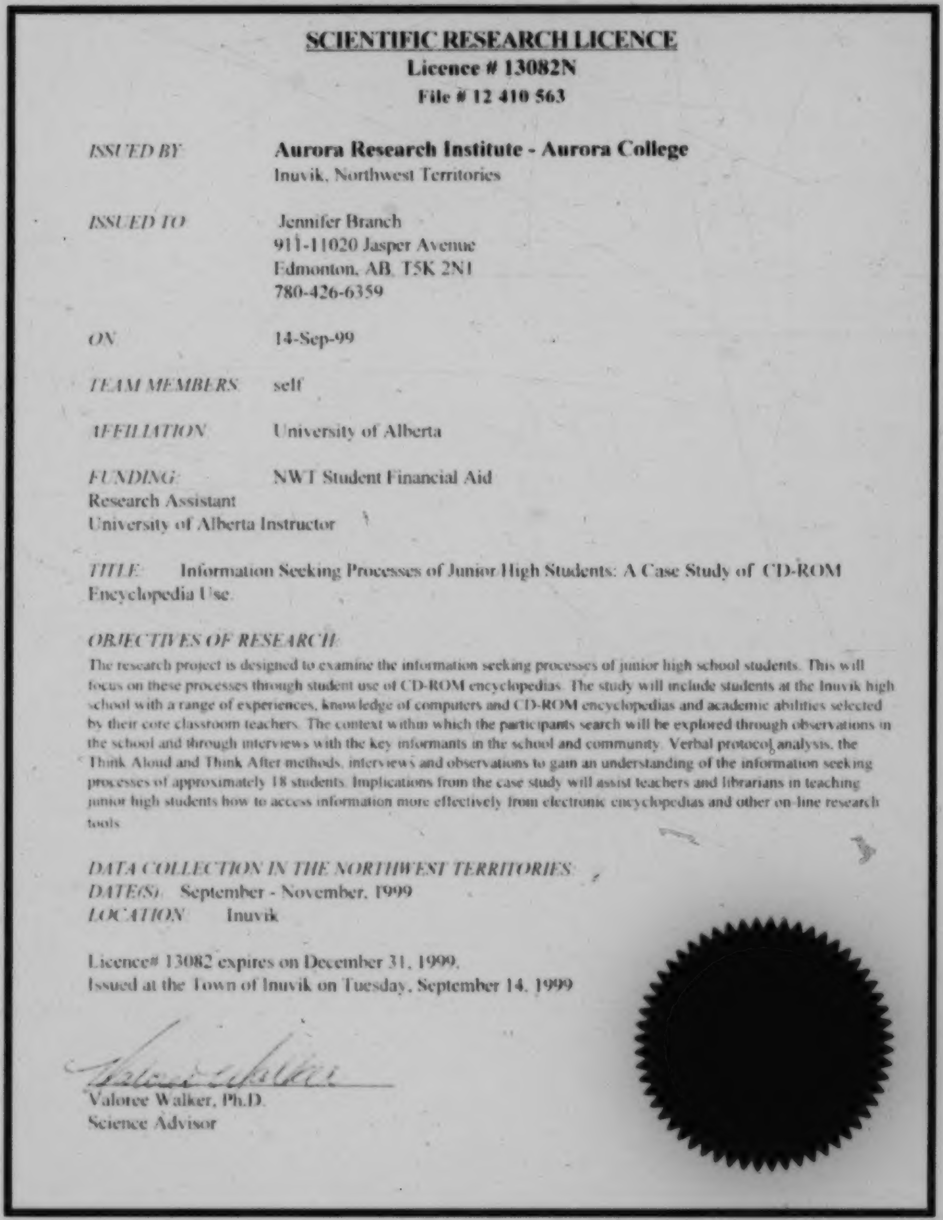
NOTIFICATION OF RESEARCH
Scientific Research Licence No. 13082

DISTRIBUTION:

Manager, Inuvik Research Centre
Inuvik Community Corporation, Box 1365, Inuvik NT X0E 0T0
Nihtat Gwich'in Council, Chief Counsellor, Box 2570, Inuvik NT X0E 0T0
Mayor, Town of Inuvik, Box 1160, Inuvik NT X0E 0T0
Chairperson, Inuvik District Education Authority, Box 1468, Inuvik NT X0E 0T0
Director, Beaufort Delta Education Council, Bag Service 12, Inuvik NT X0E 0T0

APPENDIX D

Northwest Territories Research License



SCIENTIFIC RESEARCH LICENCE

Licence # 13082N

File # 12 410 563

ISSUED BY: **Aurora Research Institute - Aurora College**
Inuvik, Northwest Territories

ISSUED TO: Jennifer Branch
911-11020 Jasper Avenue
Edmonton, AB T5K 2N1
780-426-6359

ON: 14-Sep-99

TEAM MEMBERS: self

AFFILIATION: University of Alberta

FUNDING: NWT Student Financial Aid
Research Assistant
University of Alberta Instructor

TITLE: Information Seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use.

OBJECTIVES OF RESEARCH:

The research project is designed to examine the information seeking processes of junior high school students. This will focus on these processes through student use of CD-ROM encyclopedias. The study will include students at the Inuvik high school with a range of experiences, knowledge of computers and CD-ROM encyclopedias and academic abilities selected by their core classroom teachers. The context within which the participants search will be explored through observations in the school and through interviews with the key informants in the school and community. Verbal protocol analysis, the Think Aloud and Think After methods, interviews and observations to gain an understanding of the information seeking processes of approximately 18 students. Implications from the case study will assist teachers and librarians in teaching junior high students how to access information more effectively from electronic encyclopedias and other on-line research tools.

DATA COLLECTION IN THE NORTHWEST TERRITORIES:
DATE(S): September - November, 1999
LOCATION: Inuvik

Licence# 13082 expires on December 31, 1999.
Issued at the Town of Inuvik on Tuesday, September 14, 1999

Valorce Walker, Ph.D.
Science Advisor

APPENDIX E

Letter of Introduction to Key Informants

School of Library and Information Studies
University of Alberta
3-20 Rutherford South
Edmonton, Alberta
T6G 2J4

September 1, 1999

Dear ______________,

As you know, I am a Doctoral Candidate in the Library and Information Studies program at the University of Alberta and am presently undertaking research at Samuel Hearne Secondary School. My areas of interest are CD-ROM encyclopedias and information-seeking processes. I am writing to ask if you would be a key informant in my study.

This research project will examine how junior high students search for information on Microsoft Encarta 98 and World Book 99. You will be asked to talk a bit about what you see as important factors that may influence the information-seeking processes of junior high students in the school. Your interview will be tape-recorded when you talk. It is hoped that information from this study will provide insight into the information seeking process of 12-15 year olds as they search for information on Microsoft Encarta 98.

I would value your support and participation in this study. Please be assured that confidentiality will be maintained. You can withdraw or refuse to answer a question at any time. The interviews will take place over the next six weeks during school time.

I will be happy to answer any questions you have or if you have any further questions about the project, please feel free to contact my supervisor, Dr. Dianne Oberg, at 780-492-4273 extension 225. Can you please complete the attached consent form to indicate your decision? Thank you very much for considering this request.

Yours sincerely,

Jennifer L. Branch

APPENDIX F

Consent Form for Key Informants

Consent Form

Project Title: Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

Investigator: Jennifer L. Branch
School of Library and Information Studies
University of Alberta

Advisor: Dr. Dianne Oberg
Acting Chair – Department of Elementary Education
University of Alberta

No ___

Yes ___, I agree to participate in Ms. Branch's study of the information-seeking processes of junior high students as they search for information on Microsoft Encarta 98 and World Book 99.

I give consent to be interviewed by Ms. Branch and to have the interview audio-taped. I understand that only the investigator will hear and transcribe the interview tapes. I understand that the information I provide will be kept confidential by not referring to me by my name but by using a pseudonym.

I understand that I am free to withdraw from the study at any time or to refuse to answer specific questions.

____
Name of Participant

____
Signature of Participant

____
Phone Number of Participant

____
Date

APPENDIX G

Letter of Introduction to Parents

School of Library and Information Studies
University of Alberta
3-20 Rutherford South
Edmonton, Alberta
T6G 2J4

September 1, 1999

Dear ________________,

As you know, I am a Doctoral Candidate in the Library and Information Studies program at the University of Alberta and I am presently undertaking research at Samuel Hearne Secondary School. My areas of interest are CD-ROM encyclopedias and the information-seeking processes. I am now writing formally to ask if you would allow your child to be a participant in my study.

This research project will examine how junior high students search for information on Microsoft Encarta Encyclopedia Deluxe 2000 and 1999 World Book (Deluxe). Your child will be asked to search for the answers to several questions on the encyclopedia. The information-seeking process will be tape-recorded and video-taped when they search and they will be asked to think aloud while they work and after they finish. They will also be asked about their use of computers. It is hoped that information from this study will provide insight into the information-seeking processes of junior high students as they search for information on CD-ROM encyclopedias.

I would value your support and consent for your child to be involved in this study. Please be assured that confidentiality will be maintained. They can withdraw or refuse to answer a question at any time. The observations and interviews will take place over the next six weeks during school time. The teachers involved have assured me that students will be allowed to catch up on work missed or will be excused from assignments.

Please discuss this study with your child. If you have any further questions about the project, please feel free to contact me, at 777-7170, or you may contact my supervisor, Dr. Dianne Oberg, at 780-492-4273 extension 225. Please complete the attached permission form to indicate your decision. Thank you very much for considering this request.

Yours sincerely,

Jennifer L. Branch

APPENDIX H

Consent Form for Participants

Consent Form

Project Title:	Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use
Investigator:	Jennifer L. Branch School of Library and Information Studies University of Alberta
Advisor:	Dr. Dianne Oberg Acting Chair – Department of Elementary Education University of Alberta

No ___

Yes ___, I agree to participate in Ms. Branch's study of the information-seeking processes of junior high students as they search for information on Microsoft Encarta 98 and World Book 99.

I give consent to be interviewed by Ms. Branch and to have the interview audio and videotaped. I also give permission for my thinking processes to be recorded while searching for information. I understand that only the investigator will hear and transcribe the interview tapes. I understand that the information I provide will be kept confidential by not referring to me by my name but by using a pseudonym.

I understand that I am free to withdraw from the study at any time or to refuse to answer specific questions. If on the day of any interviewing activity, I am feeling shy or unwilling, I will not be required to participate.

____
Name of Participant

____
Signature of Participant

____
Phone Number of Participant

____
Date

APPENDIX I

Permission Form for Parents

Permission Form

Project Title: Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use

Investigator:
Jennifer L. Branch
School of Library and Information Studies
University of Alberta

Advisor:
Dr. Dianne Oberg
Acting Chair – Department of Elementary Education
University of Alberta

No ___

Yes ___, I give permission for my child ____________________ to participate in Ms. Branch's study of the information-seeking processes of junior high students as they search for information on Microsoft Encarta 98 and World Book 99.

I give permission for my child to be interviewed by Ms. Branch and to have the interview audio and videotaped. I also give permission for my child's thinking processes to be recorded while searching for information. I understand that only the investigator will hear, see and transcribe the audio and videotapes. I understand that the information my child provides will be kept confidential by using a pseudonym.

I understand that my child is free to withdraw from the study at any time or to refuse to answer specific questions. If on the day of any interviewing activity, your child is feeling shy or unwilling, your child will not be required to participate.

____
Name of Parent

____
Signature of Parent

____
Phone Number of Parent

____
Date

APPENDIX J

Letter to Participants and Parents about Profiles

School of Library and Information Studies
3-20 Rutherford South
Edmonton, AB
T5K 2N1

Monday, January 31, 2000

Dear ______________________________

Hello from Edmonton! I am busily working on my dissertation about the information-seeking processes of junior high students at Samuel Hearne Secondary School. I have just finished writing little profiles or biographies about each of the participants. The profiles are based on the first interview we did back in September or early October of 1999. At that time, we talked about your family and how you spend your free time. These profiles will be included in the dissertation to help the readers know a little bit more about the participants.

I have given you a pseudonym (a made-up name) to protect your identity. Please read over the profile carefully to make sure that you are happy with what you said and what I wrote. If there are any changes you would like to make, things you would like to take out, or things you would like to add, please feel free to do so.

I am hoping that you will continue to give your consent to be involved in the study. I am finding the study to be very interesting and I know that many teachers and teacher-librarians will benefit from this research. Your participation is very much appreciated. I will be sending a copy of the dissertation to the school library, the public library and the Aurora Research Institute.

Please return the profiles and consent forms to me in the postage paid envelope as soon as possible. Thank you again for your support of my research. If you have any questions, please feel free to call me at my office, 780-492-3930, or at home, 780-426-6359.

Yours truly,

Jennifer L. Branch

APPENDIX K

Continued Participation Consent Forms for Participants

Consent Form

Project Title:	Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use
Investigator:	Jennifer L. Branch School of Library and Information Studies University of Alberta
Advisor:	Dr. Dianne Oberg Acting Chair – Department of Elementary Education University of Alberta

No ___

Yes ___, I agree to continue to participate in Ms. Branch's study of the information-seeking processes of junior high students as they search for information on Microsoft Encarta 2000 and World Book 99.

I give consent for my profile and the information from the audio and video tapes to be used in the study. I understand that the information I provide will be kept confidential by not referring to me by my name, but by using a pseudonym.

I understand that I am free to withdraw from the study at any time.

____
Name of Participant

____
Signature of Participant

____
Phone Number of Participant

____
Date

APPENDIX L

Continued Participation Permission Forms for Parents

Permission Form

Project Title:	Information-seeking Processes of Junior High Students: A Case Study of CD-ROM Encyclopedia Use
Investigator:	Jennifer L. Branch School of Library and Information Studies University of Alberta
Advisor:	Dr. Dianne Oberg Acting Chair – Department of Elementary Education University of Alberta

No ___

Yes ___, I give permission for my child ____________________ to continue to participate in Ms. Branch's study of the information-seeking processes of junior high students as they search for information on Microsoft Encarta 98 and World Book 99.

I give consent for my child's profile and the information from the audio and video tapes to be used in the study. I understand that the information my child provides will be kept confidential by using a pseudonym.

I understand that my child is free to withdraw from the study at any time.

____
Name of Parent

____
Signature of Parent

____
Phone Number of Parent

____
Date

APPENDIX M

Think Aloud Transcript Example

J: I want you to find out about, tell me who the first woman in space was. The very first woman who went to in space. Do you know who it is?

No. Did is just happen recently?

J: No, a long time ago.

A long time ago.

J: Yup.

First woman in space.

J: You have to think of what you might look for and type it in and go from there. Oh, and you have to talk as you are doing it. Tell me what you are doing.

I am going to go to astronauts.

J: Okay. How come?

Because it tells you about space. It tells you about shuttles and

J: Good.

All the other stuff.

J: Type it in then.

How do you spell

J: a u t. Okay now. This is the list of all the articles so

Okay, astronaut.

J: You have to click on the one that you want.

Wrong one.

J: Okay if you don't then just click your back button if you made a mistake.

Mumbling. (reading list of articles)

J: There are lots of those that have astronaut in them. If you go back up to the top, there's two sections. There's this section, that are topics about astronauts, and then there is a section that just have the word astronaut anywhere in them. So that's it. If you want astronaut just click on it.

Article introduction, milestones, her?

J: Well, you'll have to have a look around okay. See what it says about her.

As part of the space shuttle Endeavour mission in 1992 Mae Jemison became the first African-American woman to travel in space. Jemison had developed experiments designed to test the effects of weightlessness on humans and animals.

J: Okay, was she the first woman?

Hm, hm.

J: Okay, well then go back and see if you can find. This is a good place to be. Look and see what else you can find.

What do astronauts do? Astronaut selection

J: And if you want to read one of these just click on those and it'll come up.

Related articles. In here?

J: Could be.

Mumbling.

J: I think what, if you want to click on one of these then the words, the printing will come up. If you go to the top, to the introduction.

Here?

J: Just move up there. Click on introduction and then the typing will come up. Click on here. There you go.

I see.

J: Then you can read down.

Okay.

J: You don't have to read to me but you can look down at them and see if you can find the answer.

Okay.

J: And then if you want to click on that little arrow

Yeah.

J: Click on that little. That will tell what where you are so you can if you want to just read the introduction. And if you don't want that there you just click off it. Yup.

I see. Cosmonauts. The moon. Do I read this all?

J: Well is that, is that what where you are going to find your woman on the

Maybe.

J: Do you think she was on the moon?

No, in space.

J: In space. That is what I want. So just keep going to down. There might be more down here. It is a big, long article and there may be more.

First U.S. Astronaut in Space. That's one.

J: We already saw her. She was the first African-American. Wait a minute, slow down.

Go down.

J: No, slow down, go up there a little bit and see. There is a little section there.

This?

J: Well have a look and see if there are any ladies' names. Those blue names means that they are people and that there are stories about them.

Yuri Gagarin. Three orbit flight - cosmonaut Valentine (mumbling). Can I go here?

J: Click on John Glenn. What did he do? What is he famous for?

He is famous for 1921 US Senator and astronaut ...He also became the oldest person to go into space.

J: Is he the first woman?

No.

J: Okay. Then click back and see if you can find the first woman.

Let's see. A Gordon.

J: Is he a relative?

No. I don't think so. That's cool. There are lots of Gordons.

J: Mm mm.

There are lots. They might have the first name Gordon or the last name Gordon but some might not be related to me. Go back. So.

J: That is where you just were.

Oh.

J: Well, want to try try another search term or

I guess so.

J: Go to find, up in the top corner there and try something else. What might you want to try instead of astronaut?

It has to be about space.

J: The first woman in space. That's what you want to know

Would it be in. Where was she from?

J: She wasn't from Canada, I will tell you that. Unfortunately. We had had Canadian astronauts but our female astronaut wasn't the first.

Is that it?

J: It's just a picture.

(scanning down list of articles) Lots.

J: Yup, lots.

I'll try. What country was she from?

J: I can't tell you or you'll find the answer real quick.

(reading Columbia astronauts article) (reading first U.S. astronaut in space article)

J: Kay, what do you find there?

First man in space.

J: America's first man in space.

Yeah. So we're getting kind of close

J: You are getting close. That's just the story of his flight.

Just the story of his flight all the way down?

J: Yup. You read that one already.

What is astronautics?

J: I don't know. It's about the study of what astronauts go through when they are in space.

Oh, pardon me, what were you going to say?

J: No I was just going to say how. Is it getting frustrating trying to think of some other - maybe astronaut isn't the best way. Maybe there is some other way to find the answer.

Yeah.

J: Can you think of another way?

Um, can I type in

J: You can type more than one word if you want.

First. Can I put first lady in space?

J: You sure can.

Okay.

J: First woman in space or something like that sure.

J: What are you typing in?

Astronauts. First woman. Can I put first astronaut woman in space?

J: Or just try first woman and see what happens. Because you have astronaut from before.

Okay.

Space is umm?

J: C E.

C E, yeah. Okay.

J: What did you find?

From the first woman in space

J: That's just what you typed.

Fisher, Anna Lee. Should I try her?

J: Sure.

American astronaut and medical doctor born in St. Albans, New York. Dr. Fisher was one of the first 35 astronaut candidates picked for NASA.

J: She's not the one.

It should be in there.

J: It should be on that list. You are right.

Let's try.

J: Maybe you have to click her again.

Lucid, Shannon Wells 1943 - United States astronaut and biochemist. Lucid was a member of the first group of astronauts.

J: You don't have to read it.

She was?

J: She was one of the first but she wasn't the first.

Okay. Next name. Judith Resnick (1949-1996). One of the first. Was she?
J: No.

(chose space exploration)

J: It's a big article that is why it's taking so long.

Really long.

J: It sure is.

Do you think there is anything on this page?

J: Well, go back and try some of the other ones because that one is really big. Look for some shorter ones to try before you go back to that one.

First American woman to walk in space.

J: Well she wasn't the first woman in space she was the first to walk in space.

Mm hm.

J: Try the next one. No those are all ones. Try the next one.

Yeah, she was.

APPENDIX N

Think After Transcript Example

J: Let's just play back that little bit. It won't take very long. (video playing) Okay so population of Alaska in 1996. What did you expect, like a chart or something that would show its population and of the cities.

Maybe, sometimes it's possible that something like that could come up.

J: Okay. So you didn't know the capital city?

No.

J: Did you know any cities?

Yeah.

J: But you didn't think of trying those?

No.

J: Okay, how come?

Mm just. I won't go right to it if I am not too sure.

J: Okay. You typed in Alaska's population of the capital city in 1996. And you got words don't appear together in any of the articles. And then what did you try. Population of the capital. You got quite a long list including Alaska which came up.

Right.

J: Then you did population of the Alaska capital, I think. And that was no topics found. And then you sat here for a long time. What were you thinking?

I was thinking what to type.

J: What was going through your mind? What things might work?

Alaska's capital, the population of Alaska's capital in 1996.

J: So you sat here contemplating and then you typed in Alaska's capital 1996, Alaska's population 1996 and that didn't work. You tried Alaska's capital. And then on that list there was Alaska, something, something, Juneau, something, Sitka, Yukon Territory. And I kind of said what are you thinking now?
And then you clicked on Juneau. You knew Juneau was in Alaska?

Yeah.

J: Did you know it was the capital when you saw it then?

Yeah.

J: Okay. What happened, what would have happened if Fairbanks, Juneau and Anchorage had all come up?

Like on the same one?

J: On that same list that we were just looking at.

Then I would have clicked on…

J: On all three of them to find out which one? Or would you have know which one was the capital?

Yeah, I would have known.

J: That Juneau is the capital?

Yeah, once I saw the name.

J: Once you saw the name, okay. And you read the first little bit here and then you started to skim. And you were looking for what?

The population.

J: So you were looking for numbers?

Yeah.

J: You weren't looking for words?

No.

J: So you were skimming down this page and you got the yellow words and you saw numbers.

Yeah.

J: And did you have any idea what size of number you were looking for?

A big one.

J: So when you saw 29 000 that sounded right?

Yeah.

J: Because I think Fairbanks and Anchorage are both bigger than Juneau. Okay good.

APPENDIX O

Introduction to Think Alouds, Think Afters and the CD-ROM Encyclopedias

Introduction to the Research Project

Welcome and thank you for agreeing to participate in this research project. I will just spend a little time explaining what is going to happen today. The first thing that I am going to do is to put the tape recorder and video recorder on. Don't worry, I will be the only one who listens and sees the tape.

I am going to explain the project you are going to be working on and then we will do a little practice session. I will give you some time to explore how Microsoft Encarta works and then we will get started.

I want you to know that you can stop and ask me questions at any time. You can refuse to answer any question or you can stop at any time.

Do you have any questions now?

Introduction to Concurrent Verbal Protocols (Think Alouds)

The first thing I want you to do is practice thinking aloud as you explore the introduction to the encyclopedias. Tell me what you are thinking and what you are doing as you do it. At first it will seem a little strange but keep doing it. I promise that it will get easier as you do it. If you stop talking, I will just remind you to keep telling me what you are thinking.

Introduction to the CD-ROM Encyclopedias – Microsoft Encarta Encyclopedia Deluxe 2000 and 1999 World Book (Deluxe)

This is Microsoft Encarta Encyclopedia Deluxe 2000. It is an encyclopedia on 2 CD-ROMs. We will go through the introduction to the encyclopedia provided on the CD-ROM. It shows the main screen and the different ways of searching the encyclopedia. Think aloud as you go through the introduction. If you want to stop at any point or have any questions just let me know.

This is 1999 World Book (Deluxe). It is an encyclopedia on 3 CD-ROMs. We will go through the introduction to the encyclopedia provided on the CD-ROM. It shows the main screen and the different ways of searching the encyclopedia. If you have questions or want to stop at any point just let me know.

Good! While you are searching for information on the CD-ROM encyclopedia, I will expect you to think aloud on two search activities just like you have done here.

Introduction to Retrospective Verbal Protocols (Think Afters)

Now that we have finished the Think Alouds, I am going to play back the videotape. I will ask you to tell me about what you were thinking when working on the CD-ROM encyclopedia. If you have anything you want to stop and talk about, please feel free to stop the video camera.

APPENDIX P

Research Chronology

Research Chronology

September 17, 1999	Arrived in Inuvik
September 18, 1999	Picked up Research License
September 21-24, 1999	Meetings with Teachers Meetings with Parents Meetings with Administration
September 24, 1999	Meeting with all Participants
September 27, 1999	Organized Research Setting Installed CD-ROM encyclopedias
September 28, 1999	Initial Interviews with Chris Bob
September 29, 1999	Initial Interviews with Ken Carol Fran Dave Eric
September 30, 1999	Initial Interviews with Lynn Paul
October 4, 1999	Initial Interview with Amanda
October 5, 1999	Initial Interview with Sue
October 6, 1999	Search Session 1 with Eric Carol Dave Ken

October 7, 1999	Search Session 1 with
	Paul
	Fran
	Lynn
	Abby
October 13, 1999	Initial Interview with
	Miranda
	Search Session 1 with
	Chris
October 14, 1999	Search Session 1 with
	Mary
	Sue
	Search Session 2 with
	Lynn
	Abby
October 15, 1999	Search Session 2 with
	Dave
	Ken
October 21, 1999	Search Session 2 with
	Eric
	Paul
	Fran
	Carol
October 28, 1999	Search Session 2 with
	Chris
	Bob
	Mary
	Sue
October 29, 1999	Search Session 3 with
	Eric
	Carol
October 29-31, 1999	Visit from Supervisor, Dr. Dianne Oberg
November 1, 1999	Search Session 3 with
	Paul
	Ken
	Abby

November 2, 1999	Search Session 3 with Dave Lynn Chris
November 3, 1999	Search Session 3 with Fran Sue
November 4, 1999	Search Session 3 with Bob Mary
November 5-6, 1999	Interviews with Key Informants
November 12, 1999	Left Inuvik

APPENDIX Q

Instructions for Search Session 3

Search Session 3

Our next meeting will take place after October 28th. That will be our last get together and you will be able to search for any topic that you are interested in.

Think of four questions that you would like to search for information about and bring this sheet next time.

1.

2.

3.

4.